

YOUR COMPUTER

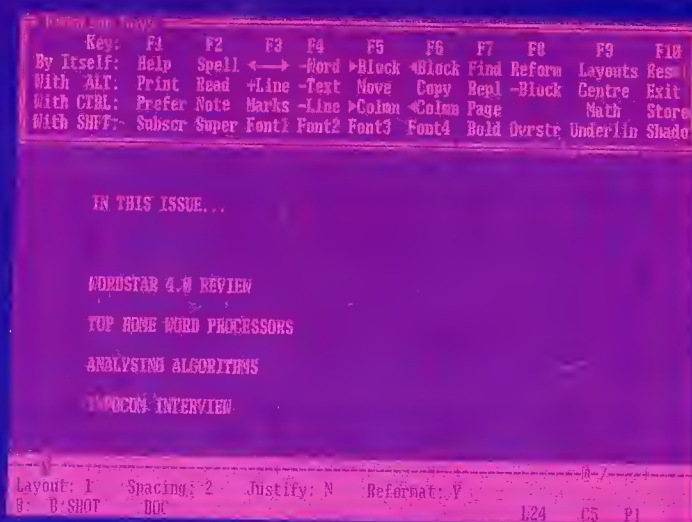
May 1987 £1.20

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WORDPLAY

THE WP WINNERS
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AMSTRAD, BBC

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BOXES



FLEET STREET
PUBLISHER

PROFILE:
INFOCOM'S
DAVE LEBLING



WIN AN ATARI ST

With monitor, data £100 of software you (Until mummy catc



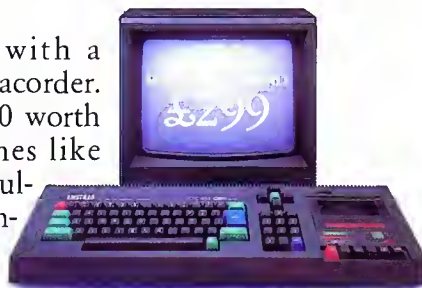
With the Amstrad 464 home computer the fun starts as soon as you get it home.

Because unlike many other home computers the 464 comes complete with its own green screen or full colour monitor.

It also comes with a convenient built-in datacoder.

And you get £100 worth of software with games like Harrier Attack and Sultan's Maze. Not to mention Oh Mummy.

64K of RAM



means you have plenty of memory to play with. And there are over 200 Amstrad games you can play, many exclusive to Amstrad.

But games are only half the fun on the 464.

The kids can learn spelling and arithmetic with software like Wordhang and Happy Numbers.

Whilst adults will love the way that it helps around the house with budgeting and accounts.



order and
u can't lose.
hes you.)



To help you make the most of your 464, you can join the Amstrad User Club.

And there are lots of books and magazines devoted to it as well.

What's more you can buy joysticks, printers, disc drives, speech synthesisers and light pens to make it even more fun.

But perhaps the most pleasurable thing about the 464 is the price.

The complete home computer costs just £199 with green screen or £299 with colour monitor.

Not much to pay for a chance to get away from mummy.

Please send me more information.

Name _____

Address _____

464 YC/04/87

The Amstrad 464.
The complete home computer.

Amstrad P.O. Box 462, Brentwood, Essex CM14 4EF.

contents



COVER FEATURE

TAKE OUR WORD FOR IT 34

Paul Hendy selects his favourite word processing packages for the BBC Micro, Atari ST, Amstrad CPC and PC ranges.

REVIEWS

BOOKS 22

The latest guides and manuals, plus how to get your train set really steaming.

HOLLYWOOD HIJINX 48

Comedy capers in the latest Infocom adventure.

FLEET STREET PUBLISHER 58

Mirrorsoft brings desk-top publishing to the Atari ST. Read all about it with Stephen Applebaum.

LIKEABLE LAP-TOP 64

Geof Wheelwright gets to know Cambridge Computers' latest project, the Z88.

C FOR YOURSELF 68

MS-DOS and PC-DOS C compilers exhaustively tested and rated by Adam Denning.

SOFT RELEASE 72

Fingers on the fire button our hard-working team shoot-'em-up and live to tell.



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ISSN 0263 0885**

© 1987 Focus Magazines Limited.
Printed by The Riverside Press,
England.
Typeset by Time Graphics Ltd.,
Northampton.

Distributed by Quadrant Publishing Services, Quadrant House, Surrey, SM2 5AS. Telephone 01-661 3239.

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Subscriptions: U.K. £15 for 12 issues, Overseas (surface mail) £25 – airmail rates on request. Please make

cheques/postal orders payable to Focus Magazines (allow 5 weeks from receipt of order to delivery of first subscription copy). Send orders to Your Computer Subscriptions, Oakfield House, Perrymount Road, Haywards Heath, RH16 3DH. Telephone (0444) 459188.

Back issues of the magazine from January 1986 onwards are available for £1.50 (U.K.), £3 (Overseas) from the Back Issues Department, 79-80 Petty France, London, SW1H 9ED.

REGULARS

NEWS

6

Competition for the Z88, the new IBM machines and yet more software.

LETTERS

13

Your reactions to the new look *Your Computer*.

LINE NOISE

16

The latest communications buzz.

ADVENTURE PLAYGROUND

24

The gruesome truth about Dave Lebling; the man from Infocom in conversation with Mike Gerrard.

MUSIC SCORE

40

Hit the perfect beat – PSG programming on the Amstrad CPC and Spectrum Plus 2.

FEATURES

BBC BOXES

18

Two new products bring music to your Micro – Ian Duerden tests the Barry Box and Rice Drums and reckons they take some beating.

HANOVER HORIZONS

30

Apple and other manufacturers displayed their latest products at the Hanover Show. Geof Wheelwright went to see . . .

ANALYSING ALGORITHMS

44

What is an algorithm and how do you analyse it? Marcus Jeffrey explains all.

COMPETITION

50

Your chance to own one of four advanced Atari 520 STFM micros in our exclusive competition.

ADVENTURE BUILDING

52

Further into the adventure programming maze with Pete Gerrard, you too can create the ultimate nightmare.

READER SURVEY

67

Tell us who you are and what you want and you could win a free subscription.

MAY 1987

COMMENT

A word processor in every home sounds like an ideal situation, but is it altogether a good thing? Reviewing Wordstar 4 with its built-in spelling checker and thesaurus made us wonder if over-reliance on computer assistance is likely to improve or worsen the way people write. It is becoming ever easier to delegate to the software the responsibility for the style of what is written. Douglas Adams, otherwise as passionate an advocate of personal computing as one could hope to meet, had some interesting comments on the subject which you can read in next month's interview.

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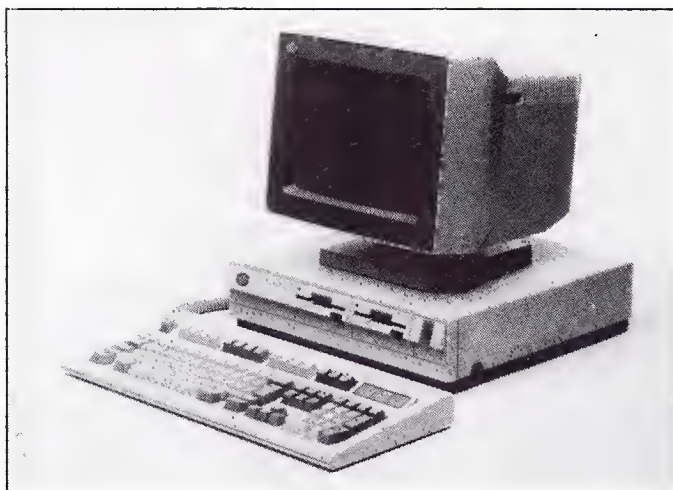
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NEXT MONTH

Douglas Adams, author of *The Hitch-Hiker's Guide To The Galaxy*, likes the Macintosh so much he has five of the. He talks to *Your Computer* about how computers have shaped his work, why you should all buy his latest book and how *Bureaucracy* can get you into trouble.





● **IBM Personal System/2: making its bow on the business circuit.**

IBM's secret weapon on the PC horizon

The launch of the new IBM personal computer range was not as exciting as many industry pundits has predicted. In some quarters there had been fears of a completely different architecture, resulting in computers which would effectively render the many IBM-compatible contenders obsolete overnight. Fortunately for existing PC users as well as the clone manufacturers the changes in the IBM range turn out to be evolutionary rather than revolutionary.

The existing PC and XT ranges continue in production, through at reduced prices. The new range is collectively dubbed the Personal System/2, and features four basic hardware configurations using the Intel 8086, 80286 and 80386 processors. The upper end of the range is outside the scope of *Your Computer*, but the entry-level Model 30 is an interesting machine.

The switch from old-fashioned 5¼ inch disk drives towards the 3½ inch format is the change likely to have most impact. The smaller disks were first used by IBM on the PC Convertible laptop micro, and a considerable amount of

PC software is available on this format. Nevertheless, anyone with a large library of data and software on 5¼ inch floppies will find it a tedious and possibly expensive process to make the conversion.

There are advantages to the new disk size, however. Apart from the inherent robustness of the compact 3½ inch disks, they also hold 720K each on the Model 30; twice the capacity of the usual PC floppy. Display boards are also improved.

Hewson runs guns for Spectrum

Hewson can't wait for Spectrum owners to try its latest release on the Spectrum. It's called Gunrunner and will be with dealers from May 20, price £7.95. It will transport you to the doomed, ice-packed planet of Zero, where programmer Christian Urquhart has laid on plenty of terrors to stop you saving the planet from inevitable termination. Hewson has also

lined up Eagles at £8.95 (or £12.95 disk) for Commodore 64/128 from May 27. The following month Zynaps will take gamers through asteroid storms to an alien-infested space station. Unfortunately you won't be meeting Sigourney Weaver on this trip! Prices run from £7.95 to £14.95 on Spectrum, Commodore and Amstrad. Zynaps is by Dominic Robinson and John Cumming. Dominic converted Uridium to the Spectrum, and Hewson is expecting big things from this team.



● **Compilation: from US Gold.**

War-torn

Relive the battles of the second world war! Battle for Normandy! Join the North Africa Campaign! Trundle across the snow in the Battle of the Bulge! Become the combat leader in a struggle of wits! US Gold allows you to do all of this – all over again – with War Game Greats, a £14.99 compilation (£19.99 on disk) of four explosive Commodore 64/128 epics originally created by Strategic Simulations.

Leonardo's problems

A start-up outfit called Creative Logic is testing the water with a package called Leonardo for users of IBM XT's or ATs or compatibles with at least 512K RAM. The firm, based in Uxbridge, Middlesex, sees its package as solving 'complex real-world problems'.

Whether this means it gets to grips with the tragedy of whale slaughter or the inability of some television comedians to be funny is not clear – but it is claimed to be capable of tackling fault-finding and diagnostics 'for just about any type of technical troubleshooting', as well as building 'systems to advise on complex regulations such as statutory sick pay, pension schemes, or holiday entitlement'.

Leonardo can be bought mail order for either £149, £695 or £1,995, depending on which level you want. Enigmatic smiles of artists' models are presumably thrown in free of charge.

Mates on Microlink

Microlink, part of the British Telecom Gold network, played an important part in the CDS/Ceefax Under 18 Quickplay Junior Chess Tournament which reached its climax in mid-April.

Over 560 competitors from all over the UK joined in the event, which was organised by the British Chess Federation.

The eight finalists were Alasdair McIntosh of Edinburgh, John Cairns of Belfast, Paul Dargan of Whitley Bay, Graeme Buckley of Wolverhampton, Christopher Walsh of Port Talbot, and in London, Mark Morris of Barnet, Michael Hennigan of Muswell Hill, and Aaron Summerscale of Putney.

Microlink conveyed each move between competitors, and relayed the action to the BBC's Ceefax service, which has an audience of six million viewers.

CDS Software provided a colour Amstrad CPC 6128 for the winner and an Amstrad 8256 to the winner's school.

All-new slant on printers

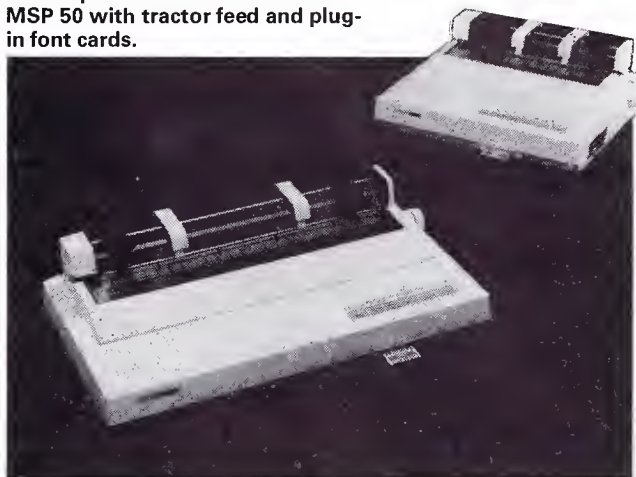
Citizen Kane knew all about tabloid newspapers; Citizen Smith knew all about revolution in Tooting; and Citizen Europe knows all about dot matrix printers.

It has added two new nine-pin printers to its range and they each offer a font card slot for a plug-in IC card to give alternative type styles when operating with appropriate computer software.

The prices of the MSP 50 and MSP 55 are £799.25 and £603.75 including VAT respectively. Draft mode can reach 300cps and NLQ chugs along at 50cps.

Both printers carry push and pull feed tractor as standard with bottom feed to aid multi-part stationery feeding. The MSP 55 will be on tap from June, with the MSP 50 following in August.

● Citizen printers: the MSP 55 and the MSP 50 with tractor feed and plug-in font cards.



C packages come to life

Softsel Computer Products has scooped a deal with Living Software to distribute its range of products for C programmers, entitled Living C, using IBM PCs or compatibles. Living C's features include a menu and help system; animation of source code during program execution; advanced data manipulation facilities; and a full feature text editor offering cut and paste, search and replace facilities; plus the ability to undo commands.

Tackling the supermarket micros revolution

Checkout computers are on the march in the high street. You can't do much shopping these days without being affected by bar codes and smartcards and personal index numbers – or at least by the threat of them.

Ericsson Information Systems is one of the companies which likes to tell the world it is at the forefront of this revolution. It's part of a Swedish multi-national organisation which employs 75,000 people in more than a

hundred companies.

Joining them is Rod Dimmock, who becomes the company's new sales manager for its electronic funds transfer operations in the UK.

Rod will get to grips with the company's involvement in the National Westminster Bank's Streamline EFTPoS experiment, the Shell/Barclaycard petrol station pump automation project, and ticket machines at good ol' British Rail.

Robtek sets target

There's a new name on the software horizon from this month – Diamond Software. It has been formed by Robtek at Isleworth in Middlesex. The firm plans to release imported games from the German company Golden Games and US-based BCI Software and Parker Games under the new name for the UK market.

The target is 25 games released by the end of the year for Commodore 64/128, Atari ST, Amiga and Spectrum formats. Prices will range from £6.95 to £14.95 depending on format. The label leads off with Hollywood Poker, an X-rated adults-only diversion with digitised graphics.

Statistics updated for the Cup

Virgin Games has updated its Official FA Cup Football game to carry new form figures for every team in the competition, calculated by sports commentator Tony Williams. It also includes new strategic manager's questions. The price is £7.95 (cassette only) for Commodore, Spectrum and Amstrad. Virgin says the game has been repackaged for this year, but that it would be interested to hear of any dealers who are still selling the old version.



● Spot the ball: Virgin's promotional pic for FA Cup Football.

BT's 31 awards

British Telecom's computer software arm is over the moon. Its three labels – Rainbird, Firebird and Beyond – notched up 31 awards last year across Europe and in the US. As it took the company three months to tot up this total, however, we wonder what sort of computer BT uses to do its adding-up. No wonder *Your Computer's* phone bill always looks over-fat!



MONSTER MEM

GET YOUR HANDS ON THE NEW SINCLAIR 128K +2. BEFORE EVERYBODY ELSE DOES.



The new 128K ZX Spectrum +2 is more than just a monster memory.

It's the ultimate family computer.

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Before they do.

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We recommend Sinclair Quality Control Software.

To: Sinclair, P.O. Box 462, Brentwood, Essex C14 4ES.
Please send me more information about the Sinclair 128K ZX Spectrum +2.

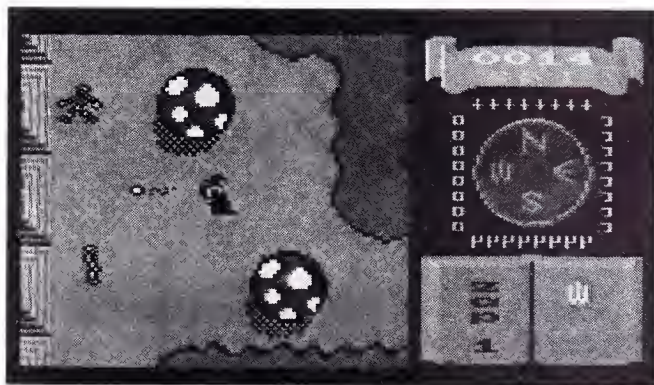
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YC7

Be a Wiz for Melbourne House



● **Wiz on the Commodore 64: sorcerors galore.**

From its base in beautiful downtown Kingston-upon-Thames in fashionable Surrey, Melbourne House has announced its latest batch of releases.

Wiz is a mythical bag-of-tricks designed by Simon Price. It takes you to the land of Midgard to meet an assorted bunch of sorcerors, wizards and apprentice wizards. The game turns up on Spectrum and Commodore from June. Prices are £7.95 to £14.95.

Doc the Destroyer, same machines, same price range,

but a month earlier, introduces you to an advanced race of super-powered heroes, led by Doc, who stretch their muscles and sinews to their limits and are represented by 'massive sprites recently developed by Beam Software'. Superstition and barbarism also abound in the scarcely-habitable world depicted in the game as the humans cling desperately to the energy dome which shields them from the ravaged, poisoned environment. Sounds like Conan meets Mad Max.

Design it with Robocom

Computer-assisted design is still one of the top buzz phrases of the decade and the one thing guaranteed to make any architect seem to be the 20th century's answer to Sir Christopher Wren.

Now Robocom wants to turn designers in schools and colleges into CAD experts overnight by offering local authorities heavy discounts on its RoboCAD-PC design software for IBM PCs.

You still need a fair stake to join the game – the special price is £1,125 instead of £1,500. Second orders to the same school shrink to £750.

The package is described by Robocom's publicity machine

as 'an easy-to-use professional draughting and design tool. It harnesses the power and speed of the modern personal computer, allowing a fresh approach to technical design'.

Then Robocom really gets technical: 'RoboCAD may also be interfaced with AutoCAD via the DXF standard interface. Extensions to RoboCAD-PC such as the powerful 3D solid modeller RoboSOLID offering mass properties, mechanical analysis and many other features are already available.'

Robocom is no slouch in the cash department, either. It is part of Eurotherm International Group, which has a turnover of £100 million a year.

Teletext on tap on IBMs

Come on – own up. Haven't you ever stared at Ceefax and Oracle pages on the box and hoped they could be accessed by your IBM PC or compatible?

What? You haven't? Well, K-Bytes of Eastleigh in Hampshire hopes that Amstrad 1512 and Apricot XEN owners, among others, will latch on to this idea and buy its Teledata 400 PC teletext adaptor card, at £310 including VAT, which downloads broadcast pages. K-Bytes says it supplies driver software to enable the adaptor to communicate with any software, and to print out selected information from teletext transmissions.

Whether or not this means you should junk your precious modem, or ignore its Viewdata facilities, K-Bytes doesn't say.

Worship at the foot of Disciple

Anyone who hangs out in Hendon in north London will have often stared into the shop window of a firm called Rockfort Products, spotted a Spectrum add-on called the Disciple, and then wondered whether they should kneel and pray or walk by sharply.

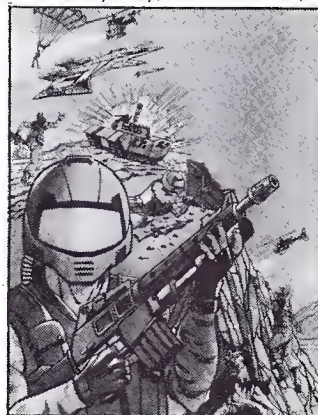
Rockfort has released the third version of its peripheral and says it allows you to link Spectrums – including the Plus 2 – to disks, printers, dual joysticks and a network. Of course, the soon-to-be-unveiled Spectrum Plus 3 is expected to have a built-in disk drive of its own. So if you are saving up to buy that, you won't need the Disciple.

Now 4 deal

Virgin has spent £100,000 on TV advertising for its latest compilation in the Now Games series. Running in Amstrad, Commodore and Spectrum versions, the Now 4 cassette is priced at £9.95 and features Dan Dare, Hacker, Back to the Future, Mission Omega plus Jonah Barrington's Squash.

Catch 23 by Martech

Remember Catch 22? That's the famous war novel in which everyone was trying to get out of the army. Now Martech – aka Software Communications – of pleasant Pevensey Bay, East Sussex,



● **Catch 23: combat.**

has gone one better with a new 'challenging combat arcade adventure'. Its name? Catch 23. First up in June are versions for the Spectrum and Amstrad, followed by Commodore and Atari ST later in the summer. Prices vary from £8.95 to £13.95.

Your task in the game – should you choose to accept it, Jim – is to steal the design of the CK23 orbital interceptor and then set a time delay mine in the nuclear reactor, destroying the island.

Publicity artwork is decidedly sub-Marvel Comics. Let's hope that isn't a guide to the quality of the game!

Roman scandals

Chargeview, of Coventry, West Midlands, has set May 11 as the release date of Annals of Rome for the Atari ST under its PSS label at £24.95 retail. The firm says the wargame 'has already received considerable acclaim' in its 8 bit version and the Atari release demonstrates 'the increasing confidence felt in the machine's potential' by PSS, which wants to make further titles available for the ST range.

PC1512s for the OU

While IBM has stolen back the PC limelight this spring with the unwrapping of its new Personal System, Amstrad, the young pretender, is still raking in orders for its PC-compatible 1512. The Open University – you know, that thing on BBC 2 – has placed the lion's share of a £2.25 million computer order for the 1512. And in the nick of time, too. The OU's Milton Keynes technology department suffered a raging blaze in March which wiped out much of its equipment. The new order for 2,250 Amstrad PCs and DMP 3000

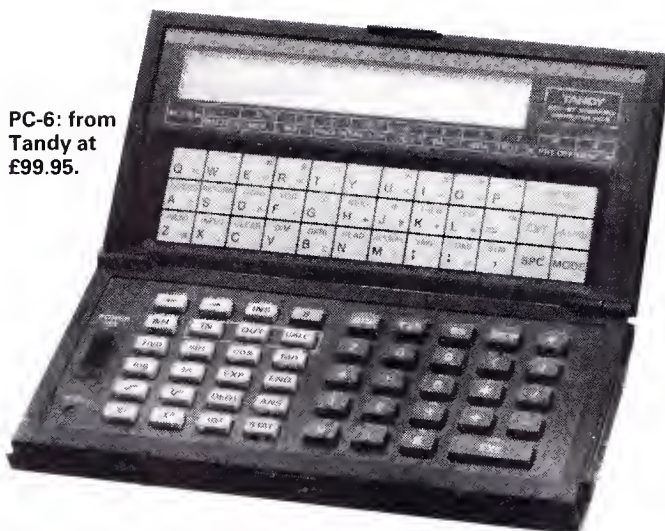
printers will help fill out the OU's stock of machines – which are available for rental to its followers.

The OU is also offering discounts to students who want to buy their own machines. Amstrads are among those computers covered in this arrangement, which has been underwritten by the government's department of trade and industry. Up to 13,000 students will be plugging into information technology and related courses by 1990.

Gremlin's Acme pact

Fans of the Road Runner will be familiar with Acme products like instant earthquake makers and automatic volcano exploders and do-it-yourself ravine builders. Acme is also the name used by a Canadian-based software development outfit, called Acme Animation. It is headed by games designer Michael Bate who has signed a deal with Ian Stewart, managing director of Gremlin Graphics Software, to put together a bundle of new projects, initially with Z80 versions of a flight simulator and an arcade game. Gremlin may be flying some of its staff to Canada to complete the work.

● PC-6: from Tandy at £99.95.



Tandy puts it on your lap

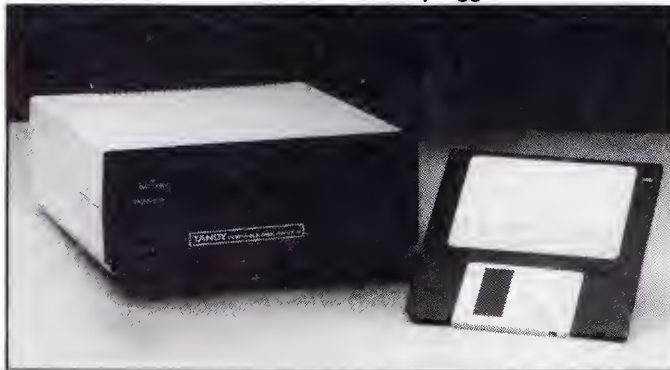
Sir Clive Sinclair's Cambridge Computer outfit isn't the only game in town when it comes to budget laptops. If you can force yourself to walk into a Tandy store, you'll find the PC-6 pocket computer at a handy £99.95 including VAT. Tandy says: 'It is ideal for students, programming hobbyists, engineers and anyone needing to carry out and record complex scientific calculations.'

'An optional mini-printer at £69.95 enables the user to print out program and data lists and operation results.'

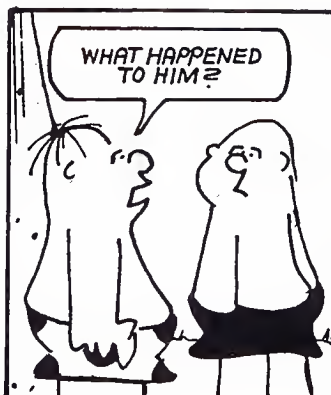
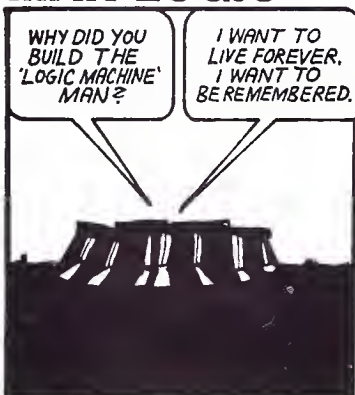
Memory is a stunning 8K RAM (Sir Clive's Z88 starts at 32K) with additional 8K RAM modules available from May at £16.95 each. Cassette/printer interface cables work out at £11.95. Batteries are lithium and you need three at a time for up to 170 hours tapping time on the PC-6.

● Tandy has also released another portable 3.5in drive for the Tandy 200, 102 and 100 laptops. It weighs in at £194.35 incl VAT and plugs into the computer's RS232 port.

● Drive time: new add-on drive for Tandy luggables.

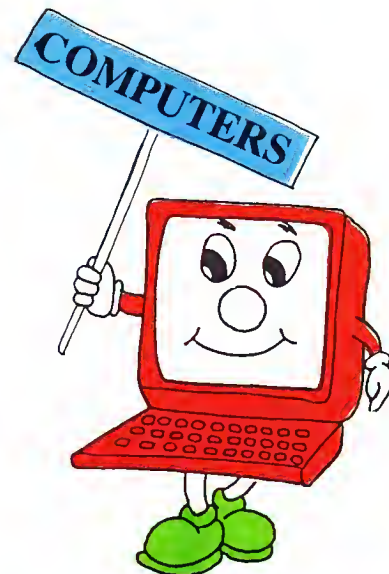
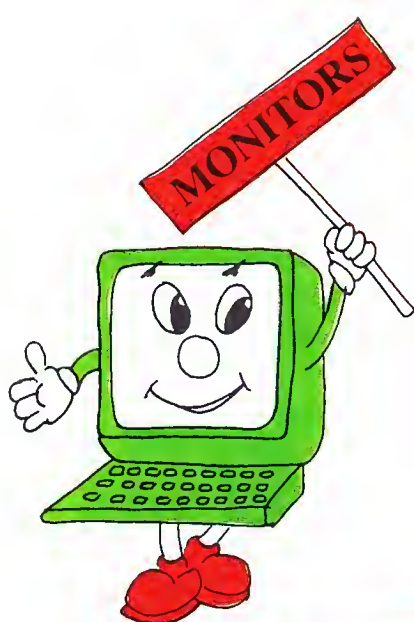


MAN LOGIC

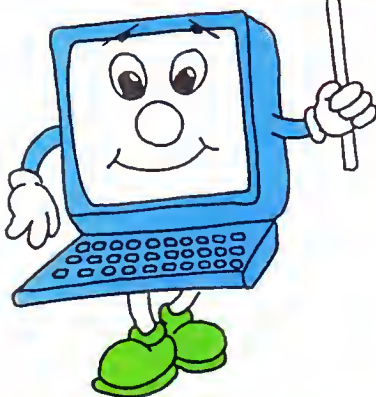


By NEIL BRADLEY

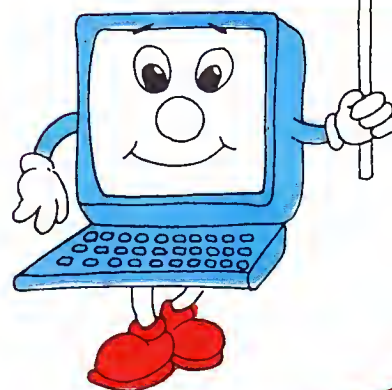
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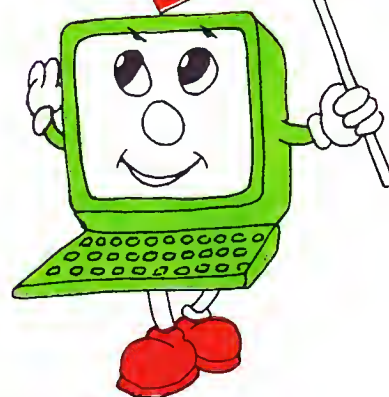
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SOFTWARE



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2 — 3rd MAY 1987

HOT NEWS!!!!

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London W8 5TD

Telephone: 01-906 3363

letters

Critical fan

I don't need to tell you how great your magazine is and how much I enjoy reading your Atari ST game reviews. But I think it is about time you updated your reviews section. In particular, you should review three games for each computer and show more Atari ST games.

I think you should have more than one person reviewing each piece of software; perhaps a master reviewer giving the bulk of the review and a second person adding a few brief comments. Then we would have a choice of opinions.

I think you should have an eye-catching award flash design for any game that gets over 90 per cent marks from a reviewer. There should also be plenty of screen shots and the best items should have two pages of review.

Why not have a pokes article where you give hints, tips and pokes on how to cheat at games. It would also be a good idea to have some pages of classified advertisements where people can offer computer goods for sale. I think you could arrange your magazine in a more tidy manner. But I look forward to seeing future issues of the new look. How about some extra pages? Your magazine is a bit thin, you know!

**Derrick Khan,
London SW4.**

Editor's reply: Here's a reader who certainly knows how to speak his mind! As you'll have seen by now, the pre-April 1987 design is ancient history. We hope you enjoy the new style. As for classified ads, we've got those at the back of the book – where they've always been. You can contact our advertising department for rates. On the point of added pages, do you think such things grow on trees?

Breathing fire

What about covering the Dragon 64 in your software exchange section? After all, I do buy your magazine. So support me!

**K. Gardner,
Leicester, Leics.**

Editor's reply: We dropped software exchange after the March 1987 issue. However, Dragon fans may be interested in the Cadmaster graphics pack and light pen marketed by Trojan Products, which is based in Swansea, West Glamorgan. The price is about £17.25 for your machine. Don't forget that listings in Basic for the Tandy colour computer should also work on the Dragon with little modification.

Cornish plea

Is there anybody there? Despite sending you at least three letters and numerous samples of Microdeal software I have yet to see or hear any signs of life. Do you think you could let me know firstly if my samples and letters are reaching you, secondly to whom should I address these samples and letters, and thirdly can I have your telephone number?

I would also like you to keep me posted by sending me back issues of *Your Computer* with reviews of our samples included and also by sending me new issues as soon as they appear.

**Mandy Sandow,
Microdeal Ltd,
St. Austell, Cornwall.**

Editor's reply: Yes, we're here ... although by the time this issue will have appeared we may have moved offices (yet again) but you can keep in touch by contacting us via the address on the contents page. Not only that, but our phone

number is printed on the contents page as well!

As for not always reviewing every piece of professional software which comes our way regardless of whether it is a game or business item or even a public domain contribution – we get so many different items, that it's impossible to mention them all, even in passing. Remember that Your Computer covers all the major machines, and some of the minor machines as well, and we really do try to give them all equal space. Honest!

Being practical

I am studying A-level technology at Wanstead high school, and as part of the practical project course I have to design a device to interface with a computer. So I need to know which home computers are the most common. Can you provide any data showing which home computers are most popular in terms of current and/or total sales?

**Gareth Palmer,
London E12.**

Editor's reply: Most micro owners we know will tell you their machines are not at all common but right royal. And of course every machine is popular with its owner! It's what's known as the my-computer-is-best-regardless-of-what-everyone-else-owns syndrome! In fact, your query reminds us of the home decorator who asked the paint shop: 'Which colour of paint do most people buy?' It's an unanswerable question.

None of the manufacturers will give totally annotated world-wide sales figures. A chain store dealer such as Dixons will probably note that Amstrad brand machines sell best. But a big London

department store such as Selfridges will see much of the attention in its micro department being paid to the Atari range. Then again, go into a specialist dealership and they'll tell you that any IBM PC or compatible except the Amstrad 1512 is all the rage. Anyway, best of luck with your A-levels.

Thanks for what

I write to you to congratulate Maplin Electronics as I posted an order on Sunday night and it arrived on Thursday. Please publish this letter.

S. J. Bennett.

Editor's reply: This certainly makes a change from the story of the chap who returned from eight years on a desert island and his shoes still weren't ready at the repair shop. But we are curious about where S. J. Bennett is based, why he forgot to include an address with his letter, what he ordered from Maplin, and why he thought Your Computer readers would be interested to learn of the result!

Edge of the wafa

Now that Rotronics has gone out of business, what can we wafa users do for repairs and new cartridges? Would it be sensible to switch to another storage system, such as microdrives (with a suitable interface for my Centronics printer)?

Many of my files are in Tasword 2 with others in The Last Word. Will this make a difference?

Would it be more sensible to abandon my 48K Spectrum ►

Something to say about personal computing? Why not share it with other readers? Write to Readers' Letters, Your Computer, 79-80 Petty France, London SW1H 9ED. Letters may be edited for length. Don't forget to include your name, age and full address.

and start again from scratch with another system, but using my existing printer?

**William Smears,
Liverpool, Merseyside.**

Editor's reply: What would seem to be a neat contingency plan provided you're basically happy with the wafadrive is to back up existing files on to cassette. Then if the drive breaks down completely, you'll have all your data accessible when Amstrad's Sinclair division brings out the much-rumoured 3in disk drive.

But if you're determined to find a reason to go out and splurge X number of pounds on a completely new system, we wouldn't dream of standing in your way.

Cut price

A local electrical store has sold me a Seikosha GP-100VC printer without manual for a knock-down price of £30. It looks identical to the GP-100A, but it isn't a parallel printer. I have assumed it is a serial printer and have tried several different pinout arrangements on a lead to try and get it working, but with no success.

Could you please help me

find out how to link it to either the BBC B or Spectrum with Interface 1?

**G. Inman,
Sheffield, Yorkshire.**

Editor's reply: The first step is to get that missing manual. Write to DDL, 710 Birchwood Boulevard, Birchwood, Warrington, Cheshire WA3 7PY.

IBM game hunt

I own an IBM PC, and can get almost every type of software for the machine in my country — except games. The only two worthwhile games I have are a flight simulator and a submarine game. I've heard a rumour going around that Amstrad games such as Silent Service, Starglider and World Games might work on the IBM. Is this true?

**N. J. van Rensburg,
Vanderbijlpark,
South Africa.**

Editor's reply: We presume you mean games which run on the Amstrad 1512 on 5.25in disk. If so, these will run on most IBMs and compatibles, providing they have the correct graphics display card installed. Also the clock rate must match the Amstrad speed system.

Adventurous

First of all I would like to thank Mike and Pete Gerrard for such interesting adventure columns. They are the first things I turn to when I get *Your Computer*.

I am very new to computer adventuring, in fact to computers on the whole. Last month I decided to treat myself to a computer. Having decided to buy one and studying all the information, I bought an Amstrad PCW 8256 and I was not sorry. To be honest one of the things that attracted me to it was the green screen.

Not being a great lover of arcade games, the first game that I bought was *Wishbringer* from Infocom. Being addicted to it is not the word. From the very first lines on the screen I was hooked. I started it on a Thursday night and finished it on the Sunday afternoon, stopping only for sleep and meals. In fact I was sorry that I rushed to finish it that I vowed that I would only spend a limited time on the next ones.

Having finished *Wishbringer* I have moved on to another Infocom game, *Zork I*, and that is where I am having a little bit of trouble, having notched up

over 20 hours (playing time) in the last two weeks.

I must admit that after playing *Wishbringer* I am finding this slightly more difficult. The thing I liked about *Wishbringer* was the detailed descriptions which I think *Zork I* lacks.

There are several things puzzling me at the moment. But perhaps solving them would spoil the fun. Is it actually fun? On many occasions I have felt depressed because something I've tried has not worked, especially if I'm having a bad day.

There are two major problems:

In whatever directions I go into the maze, I cannot get to the centre or other side. I have come across the skeleton and effects of the dead adventurer (and the ghost) but that is all.

Having been into the dome, and gone to the altar, taken the coffin and sceptre, got the scarab, read the prayers in the book, having rang the bell and stopped the ghosts in their tracks I still cannot enter. I have even been back as a dead person but I still cannot enter.

Is it possible to get to the middle of the maze or to the other side? It seems however far you go north or south you don't go anywhere; you still have the entrance to the Troll room to the east. Is the adventurer the only thing that I'll find in there?

What am I missing to enter Hades? Is it something with a louder noise, or is it as I think, something visual?

**Alan Robinson,
Birmingham,
West Midlands.**

Editor's reply: We can't promise the Gerrard brothers will find space to deal with your queries, but keep reading — just in case.



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YD

line noise

Communications

Yellow Pages goes live for finger walkers

There is no such thing, so they say, as a free lunch. As a full-time hack and veteran of many a press freebie nosh-up from which I have escaped *walleto intacta*, I can't fully go along with that sentiment. However, there does seem to be some truth in it when it comes to online services, writes Jill Phillips. thoughts was the recent launch of Electronic Yellow Pages (EYP) and the landing on my desk of a sales brochure for an outfit called the Television Information Network. Both services are free to punters, but both are paid for somewhere down the line.

There is nothing particularly innovative about putting telephone directories on computer. BT has already done it for internal use. If you're in any doubt, just try ringing directory inquiries and then listen carefully. Instead of the rustling of directory pages you will now hear the familiar clacking of computer keyboards.

The French have gone one better. These days when your telephone is installed, instead of a doorstep-size wedge of Canadian forest you get a free viewdata terminal. You use this system, known as Minitel, to access the online directory. As an added bonus, the Minitel system also carries information providers and services similar to Prestel.

So far the Electronic Yellow Pages service is pretty limited. It covers most of the London regions and Guildford, plus some information on Reading, with Watford and St Albans due to be online by the time you read this. Even then it includes only those people who advertise in the paper Yellow Pages, so the choice is narrow.

There are two ways of getting into EYP. One is to dial

direct – there are three numbers for different speeds and terminal types. The other way is to go in through Prestel, via a gateway on page 3813.

You could try that now, if you weren't busy reading this magazine, but you'd come up against a problem. When you log on the system asks you for an ID number. I'm not too sure why it bothers. It's hardly a security device as the service is free anyway. To get your ID you ring the charming people at the EYP Helpline who will give you the number you need and will also send you a guide to the system and a handy reference card. I got mine two days after ringing them, which is probably a record for BT.

Once you're in, finding your way around is easy enough. There is a text string search facility for both the area and the type of service you're after. If you've just got a numeric keyboard (as on the cheaper Prestel sets), codes can be used instead.

The first information you get will usually be quite brief – name, address and telephone number. Most of the entries have extra information available at the touch of another button, however.

The computer is in Reading, so that if you live in the London, Guildford or Watford areas and want local information, you still have to make a b1 rate call. The only way around that is to go through the Prestel gateway, which gives you local call rates – if you have a subscription.

As it stands, EYP is really no more than a demonstration of what could be possible. To become really useful it has to do three things. First, it needs to cover the whole country. Second, it needs to be available at local call rate no matter where you're phoning from, like Prestel almost is. And finally, it needs to be

much more comprehensive – indeed, ideally it should cover as much as the paper version.

The people at EYP will probably throw up their hands in horror at these suggestions. Putting that amount of information online takes a lot of money and hardware. But the French did it and, at the risk of sounding jingoistic, I don't see why we shouldn't do it too.

The other free service is the Television Information Network (TIN). I'd like to tell you more about this system, such as how they thought up such a strange name for a service that's accessed by computers and comms terminals, and when they started. Unfortunately my repeated attempts to phone the people in charge met with the engaged tone, except for one call when I apparently dropped into the middle of a conversation between two people who were arguing about expense claims.

TIN appears to operate pretty much along the lines of freesheet newspapers. There is no charge to access the service. Instead, they get their money from the advertisers.

The TIN promotional brochure claims thousands of advertisers, arranged in geographical groups, and I have no reason to dispute this. As such it probably has more to offer than EYP at the moment. Many of the advertisers provide response frames for ordering. If you want to know more, try getting through to Mr Davis on 01-486 0782.

Alas, TIN suffers the same problem as EYP when it comes to telephone bills. Two numbers are given. One is for people living in London and is a London number. The other is for people outside London. It is another London number, although cunningly re-

arranged to look provincial.

If you're within easy dialling distance of the Smoke it's worth a go, if only out of interest. The protocols are standard viewdata, 1200/75 baud, and the numbers are 01-486 0794 for London and (0193) 52972 (or 01-935 2972 – please yourself) for those outside the capital.

Assuming your telephone bill hasn't already reached National Debt levels, these systems are worth a try, if only to browse around. They are as near as you'll get to a free service.

Electronic Yellow Pages is available on the following numbers:

- (0734) 586255 – 300/300 baud teletype (scrolling) terminals
 - (0734) 597231 – 1200/1200 baud teletype terminals
 - (0734) 585151 – 1200/75 baud viewdata terminals
- The EYP Helpline is available on (0734) 506259.

French fax

You can now look at the BBC Ceefax teletext service in France via the French Teletel system. The logic in this apparently strange move is borne out by research which indicates that there are large numbers of English speakers in France, with 40,000 in Paris alone according to Intelmatique who are partnering the BBC in the project.

With a couple of million Teletel terminals already installed in France, relaying Ceefax makes sense and makes the failure of a similar move to display Ceefax on Prestel a couple of years ago quite ironic. Updates are currently relayed to France by a humble BBC Master and new items normally appear within ten minutes, though this delay is expected to be reduced dramatically.

BT changes under way

VADS stands for Value Added Data Services, the arm of BT which encompasses comms services Prestel, Micronet and Telecom Gold, as well as the Telecomsoft division for Rainbird and Firebird software.

BT has a 40 per cent share in Micronet, and Micronet's MD Tom Baird features heavily in the moves at the consumer end. Baird has relinquished his role of looking after Prestel messaging to concentrate on all microcomputer related areas. Adding to his Micronet (Prestel Microcomputing) role, Baird will assume responsibility for MUSE (MUD II) and Telecomsoft.

The result is rationalisation within VADS, headed by John Short, with a clearer distinction between business and consumer services. Baird's new boss will be Sian Roberts who will also be responsible for the BT dial-up PRLS (Premium Rate Local Service) ventures, such as the "dial-a-laugh" services.

Clem Jones takes on the role of managing UK Messaging, including the message services offered by BT Gold, Prestel and MHS (Message Handling Service) which will improve communication between the different message services (Prestel, Gold and Telex), heralded by the forthcoming Prestel/Gold link up.

Prestel's overall boss, Graham Jones, becomes head of the Business division, looking after such aspects of BT Gold and Prestel as travel agents and the Stock Market, and Prestel Education is also included within Jones' sphere.

Finally, Dave Sexton becomes responsible for all VADS hardware activities, which means he will look after the networks, including the

new Vascom system, Prestel, Gold, and MUSE computers.

It is not thought that there will be any immediate outward effect on established services, though the reorganisation should see better links between once very isolated services, and

New ventures later in the year.

New Tandata products



● Tandata's £499 high-speed modem

Adding weight to industry feelings that 1987 will be the year of the high speed modem, Tandata has announced its new Tm722 1200 and 2400 baud Hayes-compatible modem. The Tm722 is a state of the art device with auto dial and answer and featuring on board T-Link error correction. Costing it at £499, Tandata is aiming straight at the top end

● DR Gemcomm supported by TM 500.



Miracle WS3000 and Pace Series 4 competition.

Meanwhile at the other end of the market Tandata has unveiled the Tm500. This modem supports Hayes commands, V21/23 (300 and 1200/75 baud) as well as the unusual V25bis standard, which is useful for some PC comms packages. The Tm500 goes out at £199 + VAT with a tailored version of the popular Multicomm comms system for PCs called Tanlink, or £199 for the Amstrad 1512 version featuring DR Gemcomm.

Ye GODS!

It's official; GODS telephone bill is £2,000! No, we're not implying that BT have hit on the idea of billing the Almighty, the astronomical figure is the result of MUG (Multi User Game) player Colin Curless playing GODS obsessively until four o'clock nearly every morning. Add the fact that Colin lives in Cornwall and the GODS computer is in London with no local call rate access, and you quickly realise how a four figure telephone bill can become reality. The story was so unusual that even the *Daily Mail* reported it.

GODS is a relatively new MUG and joins BT's MUSE MUD 2 and Micronet Shades. GODS itself only costs £25 a quarter, and is still under final development running on a 68000-based machine, but calling from Cornwall, even at off-peak rates, was costing Colin over £2.50 an hour. Rumours abound that someone has beaten the £3,000 barrier for a quarterly phone bill, for similar reasons!

Kirk saga continues

The latest in the Kirk Automation/Modem House saga is that Kirk Automation, who manufactured the MH Voyager 7/11 series of modems, has ceased trading, with Kevin Kirk blaming Modem House (Sci-Tek Ltd) on the demise of his original company. Kirk has stressed that Kirk Automation is not in liquidation and the new Enterprise series of modems should be unaffected by the changes, being produced and marketed by a new company in Wales called Anglo.

Beebug starts database

The 20,000 strong Beeb/Acorn Electron user group, Beebug, has launched an online database on Micronet. Dubbed Databus, the new Beebug area is open to members and non-members alike and contains extracts from the monthly user group magazine, including reviews and hints and tips. Databus editorial is supplemented by a teleshopping service with discounts for Beebug members. Databus can be found on Micronet page 800909.

Dacom 1-2-3 at £399

Dacom has launched another new Hayes compatible 1200 baud full duplex (V22) modem, the 1-2-3, which also supports V21 and V23. Dacom aren't claiming any fancy features for the 1-2-3 and wouldn't be drawn on V22bis (2400 baud) capability. The 1-2-3 will cost £399, which is the same as the original Unity Gold PC card version of the 1-2-3.

BBC BOXES

Despite the speed and excellent interfacing facilities of the BBC computer, it has attracted little in the way of music add-ons. But this may be changed by the appearance of two new products – Rice Drums and Barry Box.

Rice Drums is to the BBC what Spectrum and Amdrum are to the Spectrum and Amstrad. All use a digital to analogue converter, to transform sound data in

two sets of open and closed hi-hats, a metronome and a cowbell. Some sounds are mutually exclusive, such as the toms, but you can put about six instruments onto a single step.

The sound quality is very good although it has a tendency towards an electronic rather than an acoustic kit. A greater variety of sounds would have been nice, but Rice is planning to expand its sound

In real-time the pattern plays as you add drums to it and you have to hit a function key at the exact moment you want to enter a drum into the pattern. Step-time programming is much easier. Here, you move a couple of markers across the screen to the point in the pattern where you want to enter a drum and then press the function key. If you are familiar with programmable drum machines, the process will be second nature.

A pattern can hold up to 32 steps and you can create up to 32 patterns. There are many useful editing facilities, such as being able to step back and forth through patterns, a simple copy function and the auto insertion of bass drum and hi-hat lines. You can also call up a couple of reference grids to help you lay out the pattern.

There was one slight niggle. The key repeat setting has been altered and keys respond rather sluggishly. Holding down a key fills the buffer. So, when the key is released, the operation carries on and you overshoot your mark.

With a few patterns in the computer, you can chain them into tracks. You can create up to 12 different tracks, each holding up to 80 patterns. Each pattern entry can be made to repeat a certain number of times, so it's quite quick and easy to build up a track as most drum tracks are fairly repetitive.



● Sound processing for the BBC Micro.

RAM into audio signals, which can be fed into a PA or hi-fi. However, Rice Drums differs in that its sound data does not consist of digital recordings lifted from a drum kit – rather, the sound data has been generated with the aid of a computer. The result of this combination of digital and analogue methods is the reduction of background noise to almost nil, making Rice Drums ideally suited for home recording.

As the sounds are software based, they are easily altered. The disk includes two bass drums, snare, two sets of toms,

library in the near future.

A song or drum track is built up in the same way as tracks are built up on all programmable drum machines. First, a series of one-bar patterns are programmed, then chained together to form the complete track.

The program runs in Mode 7 and the pattern screen shows a large dotted grid with the drums listed down the left-hand side. You enter the drums into the pattern by pressing a function key, enabling you to build up a pattern in real-time and step-time.

Tempo is adjustable from 1 to 255. You can switch in an echo effect to beef up some of the sounds. This made the toms sizz a little, but that may just have been my pre-release version. Tracks and patterns are saved and loaded in the A directory.

Control

For another £12.50 you can have the box fitted with a trigger output to help control the likes of Roland's SH-101 synthesiser. Trigger pulses are programmed like drums on the pattern

screen.

Comparisons are difficult because there is no other similar product for the Beeb. The next best thing is to compare it with Specdrum, Amdrum and the numerous drum units for the Commodore 64 such as the Datel Com-Drum, the Super-soft Rhythm King and the Poly Drums program for Commodore's sampler, etc. Against these Rice Drums more than holds its own.

Create your sound

The Rice Drum machine is compatible with BBC B and Master machines. It costs £45 with software on cassette and £47.50 with software on disk – state 40 or 80 track. Please note these are net prices as Rice is not yet VAT registered.

Rice is currently adding a sequencer and bass guitar synthesiser to its Drum machine. This will require extra hardware and will sell for around £85. Watch out for it.

Barry Box, named after its designer, Barry Landsberg, is not so much concerned with the sampling of orchestral stabs and their subsequent use in a recording but rather with manipulating the sample itself. The manual describes it as a sound processing unit – and that is an apt description.

Compatibility

The Barry Box package consists of the box which plugs into the 1MHz bus, an EPROM, a microphone and a cable which connects to the Beeb's power supply. It is not yet compatible with the Master, due to Acorn's amazing policy of non-upward-compatibility, but that should be corrected soon.

The main screen display lists buffer start and end positions, sample time, step size, start frequency, frequency step and number of points. Here is a quick explanation: the sample is stored in the buffer and the start and end points determine which part of the sample will be heard. The sample time can be varied from 1.5 to 40kHz. The step size comes into use when the waveform is drawn and determines how much of it appears on the screen.

Not only can the Box sample, it can also analyse and plot the frequencies of a sample. The start frequency, frequency step and number of points are used during this analysis. These parameters can be altered easily and, in case you get in a mess, Escape reinitialises them all.

Taking a sample is easy. You can start recording immediately sampling mode is activated, or engage trigger mode, in which case the unit waits for the sound to exceed a threshold level before recording. The function keys are used to instigate triggering, playing a sound forwards and backwards, loading, saving and draw-

RICE COMPUTERS

P.O. Box 2, Morecambe LA4 4PP



● The Rice Drum machine and its accompanying software.

ing operations. The graphs can be dumped to an Epson printer.

Cleaning up

Samples can be saved to sideways RAM, which will be especially welcome on the Master version. Two special software routines attempt to clean up dirty samples, although for best results you are advised to use the auxilliary input which bypasses the microphone input circuitry.

There are built-in facilities to measure the frequency of a sound in the buffer and perform automatic frequency measurements on incoming sounds with accuracy of around 0.1Hz. A tuning fork feature produces a sine wave at any specified frequency.

A useful aspect of Barry Box is the way it can be accessed from within your own Basic and machine code programs. Several examples are included in the manual. You have to type these in but they are very short. One waits for a sound, records it, then plays it forwards then backwards. The second plans a sound back at different speeds. The third produces the n-n-nineteen effect and the fourth, slightly longer, tells you to press a key and calls you names if you do not press the right one.

I managed to get hold of some other demo programs, with the help of Barry's designer. One produced a true echo effect, another produced a musical scale and another indicated distortion. It is certainly versatile.

All the samplers for other computers are designed to be used musically, eg. Datel's sampler, Microsound's Digital Music System, Commodore's sampler and Supersoft's Microvox – all for the Commodore 64. Barry Box is the first and only computer-based sampler for the BBC computer. Although it does not pretend to be a musical instrument, it can produce musical pitches, but it is not best suited to that purpose. If you want to use your Beeb to play a sample via a MIDI keyboard then you will have to keep on waiting.

However, if sounds interest you and if you would like to use them the way you want to, rather than the often limited way allowed by the software, you could have a great time with Barry Box. It costs £79.95 inc VAT and p&p.

Rice Computer Electronics, PO Box 2, Morecambe, Lancs, LA4 4PP.

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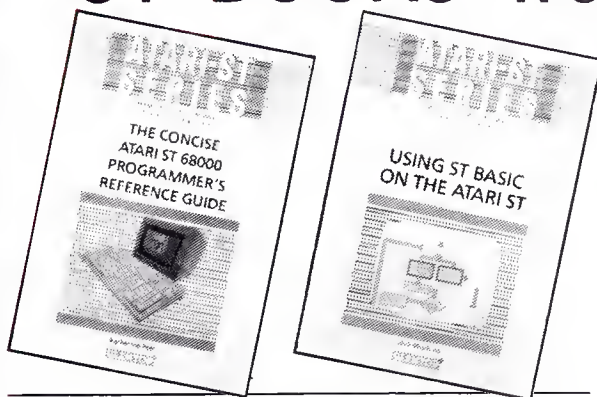
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THE CONCISE ATARI ST 68000 PROGRAMMER'S REFERENCE GUIDE

Katherine Peel

This book is a complete reference manual for the ST computers. It is designed to be used both as a quick reference manual and as a source of detailed technical material. Topics include machine-code programming, details of GEM, and the operating system. Much of the material included is unlikely to be available from any other source, making the book an essential reference manual for every Atari ST owner.

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Dick Meadows

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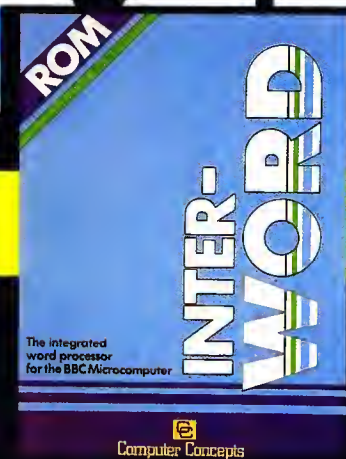
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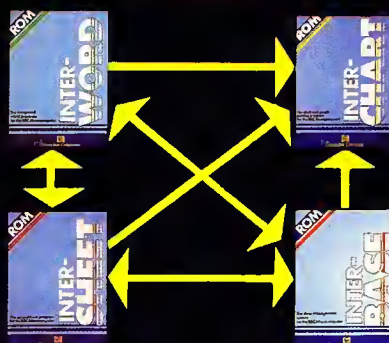
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books

Electronic Circuits for the Computer Control of Model Railways

Author: R. A. Penfold
Publisher: Bernard Babani (Publishing)
price: £2.95

Here's a book that steams along. Here's a book that doesn't run out of rails. Here's a book that's just the ticket.

In 96 pages, the author gives you all the info you need to control your model railway with a microcomputer . . . you know, the way British Rail keeps its InterCity 125 running completely on time.

You'll need a computer with an analogue to digital converter, although it may be possible to use a Centronics type parallel printer port as an output to drive simple add-ons.

**Electronic
Circuits for the
Computer
Control of
Model Railways**
R. A. PENFOLD



As you'd expect, the Acorn series (excepting the Atom or the Electron) is identified as being among the most suitable computers for the puff-puff stakes.

You'll have to learn something of the BBC's indirection command (that uses a question mark, in case you asked) to write values to output devices. With the 6502 series, Poke is the command and with Z80 machines Out is usually the command.

You are also shown some simple circuit board diagrams that you will need to follow. But don't worry – the number of components is not very great and you may even be able to build the board into an empty cassette case.

You will be surprised how many people will stare engrossed at the case when it's finished and your model railway is whirling around according to the program you've installed on the screen. You will also be surprised at how your computer will not allow you to crash trains – it's something to do with Isaac Asimov's five laws of robotics. But don't blame the book or Mr Asimov if a collision does occur between your prized locomotive, the

Orient Express and your common or garden rolling stock. Blame it on the likelihood that however good machines can be at putting some order into our lives, they can't read books about linking model railways to computers. That's something for us humans to do.

Getting Started with Basic and Logo on the Amstrad PCWs

Author: F. A. Wilson
Publisher: Bernard Babani (Publishing)
Price: £5.95

Here's another book for all those users of the PCW 8256 and 8512 who couldn't get their minds around the manuals supplied with the machine or – in the case of the Mallard Basic – bought the machine after Amstrad stopped bundling the Basic manual with it. This latest volume has 80 pages in what was once known as quarto size.

Out of nine chapters, three are devoted to covering Digital Research's implementation of Logo; and three cover Mallard Basic, first created by Locomotive Software for the BBC's Z80 add-on.

The remaining chapters try to tell you about binary code, what a three inch disk looks like, which system master disk contains the CP/M Plus operating system, what a directory is, and so on.

The Logo section, of course, starts with turtle graphics, as does every other book or manual or article on the language. (Did you expect some originality, then?)

But, when dealing with listing and writing procedures, it does point out the useful distinction between the use of quotation marks for quoting a variable name and using a colon when referring to the contents. Still none the wiser? Join the club.

DR Logo saves its procedures and programs as simple ASCII files and so you can, if necessary, edit them outside the DR Logo environment.

However, one infuriating problem with DR Logo is that although many machines run it, much of the terminology – known as primitives – is not implemented on each machine. So any procedure using the colour terms setpc, setbg or settc will be meaningless to the PCW and fill, which the PCW does admirably but is not mentioned in the volume under review, will confound some of the other versions.

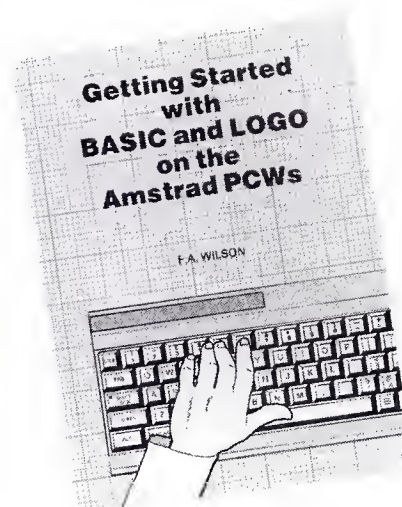
The final chapter alludes to the suitability

of the language for writing databases. But as the writer gives no fully-explored example, instead preferring to tell the computer that Mary's weight is 57kg and Anita's age is 25, we have to presume that he or she doesn't know how to write a database in Logo either.

The chapters on Mallard are somewhat better, however. We are shown how to build up a flowchart and how to understand an array.

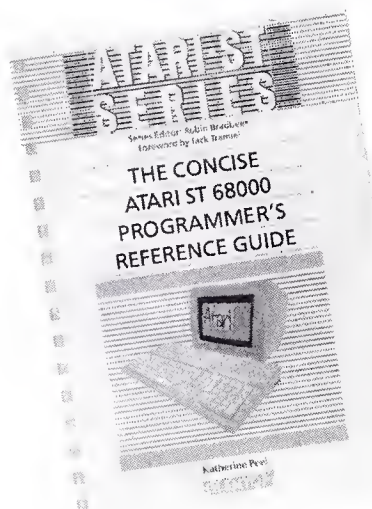
Sections cover the while and wend statements, and there's help in configuring the keyboard for Basic where it differs from the Locoscript mode.

Jetsam is given some space; we are told that sequential access, random access and keyed random access are available. We are also led into a brief program for remembering our friends' birthdays – presumably so we can buy them each an Amstrad PCW as a present.



The joys of setting up a GSX Basic file are ignored, however. We are also left in the dark with the peek and poke commands. These commands are even more essential to understand, incidentally, when using the generic version of Mallard installed on another computer. They are certainly indispensable if you want to use Mallard on a colour monitor, for example. Similarly, the .deposit and .examine commands in DR Logo are overlooked.

Overall, then, this book is capable of opening the novice reader's eyes to areas that the great majority of us take for granted. It could additionally give the newcomer the wrong idea that this computing lark is for the birds and it's safer to just stick to the Locoscript environment on the PCW.



The Concise Atari ST 68000 Programmer's Reference Guide

Author: Katherine Peel
 Publisher: Glentop
 Price: £15.95

This meaty volume of three chapters plus 14 appendices takes you on a guided tour of the sleek, super-efficient Atari ST series as seen through the eyes, ears and interfaces of the 68000 chip.

Not only that but Jack Tramiel, the leading light of Atari in the US, has taken time out of his busy schedule to pen a few paragraphs for the book's foreword.

Mind you, it reads like a sales pitch for the ST series; not surprising, when you recall that Tramiel is primarily a salesman.

The book then launches into a scan of the Atari ST hardware. We're told the likely layout of the system: how the 8MHz MC68000 16 bit microprocessor is related to the Mostek MK68901 multi-function peripheral; how much resident RAM to expect; how the ROM is going to have 192K; and where the 32-bit FIFO to the 8 bit device controllers fits into all of this.

Then, if we are unable to look at the expansion connection ports at the back and side of the console, the book gives detailed diagrams of the ports. We flow through to the pin functions on the Centronics and RS232 interfaces, among others, on our way to an outline of each processor and custom-designed ULA.

Moving on to chapter two, we find an overview of the operating system, BIOS, BDOS and memory map. Graphics and text, in high, medium and low resolutions, are covered, as are colours, animation and sound.

The Digital Research Gem dos aspects are detailed, and compared with CP/M 68K format as far as files and base pages are concerned.

In the middle of the chapter is perhaps the first item which might not be found in Atari's own manuals – a listing of the system initialisation sequence from system reset onwards.

The program header format of cartridge software – whether program or diagnostic – is given a quick run-down and then we move on to boot activities. Following that, it's back to communications interfaces, such as the midi – and that stands for musical instrument digital interface – for synthesisers and the like, if you fancy yourself as the next generation Procul Harum.

The final chapter before we get on to the appendices covers Atari ST traps and utilities. Here, we learn that the BIOS and BDOS 'use and preserve registers in a rather haphazard manner'. Funny, I always thought everything in a computer was predetermined and logical, like a certain Vulcan science officer. BIOS and BDOS calls make up the bulk of the chapter, along with attribute functions, raster operations, input functions, inquiring functions, escape functions (some of which are not yet implemented on the ST), and various routines in the shape of libraries.

That's the end of the chapters – now it's on to the appendices. They run as follows: system variables; configuration registers; Epson printer and VT52 terminal escape codes; Ascii, GSX and Gem keyboard codes; a rerun of callable functions; parameter blocks; assembly language instructions; errors; ST Basic; plugs for proprietary assemblers; sample assembly language programs; a glossary; and outline schematic diagrams – but if you need the layout of every resistor, don't look here.

For those of us who can't survive without an index, hard luck – there wasn't one in the preview copy.

The overall danger about this sort of reference work is that an unscrupulous or ignorant bookseller could well sell it to the uninitiated neophyte. But it is purely a reference work for the totally in-the-know enthusiast.

The price may be not much more than a games disk, but unless you are going to find more than a few pages of interest here that you can understand, you would be well advised to leave it alone and look elsewhere on the computer bookshelf.

Chip series

68000 pocketbook
 Author: K. D. Peel
 Z80 pocketbook
 Author: J. B. Vonk
 Publisher: Glentop
 Price: £3.95 each

These two books summarise familiar information in a handy size which would certainly be appropriate if you were lugging around a laptop and planning to do some vital programming on the bus. As it is, for the chips here discussed, the A6 size is easy to thumb through and that's the concept really.

The Motorola 68000 volume runs to 144 pages; the Zilog Z80 has 238 pages. Whether or not this means the Z80 is seen by Glentop as more complicated is doubtful. The fatter book is a reprint of a volume published in the Netherlands by one of Glentop's associate companies in the international Kluwer group.



The main bulk of the Z80 book is taken up with the assembly language instruction set and you will have seen similar information in Glentop's respected series of assembly language tutors. There are bus and control timings for such as the read/write cycle, comparisons with the Intel 8080, and a summary of the chip's internal architecture.

The 68000 volume briefly covers the 68000, 68008, 68010, and 68020 chips and how they store data. Also examined are signal input/output, accessing program code in memory, condition codes, processing states, as well as addressing modes. Again, the instruction set is given plenty of space; this time Basic equivalents are included to help explain the terms. Of course, if you have yet to master Basic this feature will be wasted.

ADVENTURE PLAYGROUND

When your editor phones you and asks if you'd like to meet someone from Infocom, what do you do? That's right: DROP EVERYTHING. I was out of the front door in a flash. Returning only to retrieve my trousers and pick up a tape recorder, I made my way more sedately to the palatial Hampstead offices of Activision, the company responsible for bringing Infocom to an even wider audience in Britain since they took over responsibility for the range last year. Having discovered that the 'someone from Infocom' was Dave Lebling, the man responsible for inflicting the grue on innocent adventurers everywhere, I considered the possibility of extracting revenge but decided I'd forgive him if he told me where the idea for the revolting creature came from in the first place.

"Yes, I must admit I invented the grues," he said. "The word comes from a creature in a series of stories by a fellow named Jack Vance, who to my mind is one of the best fantasy writers around and grucs come from a series of stories about a far future of the earth when the sun is about to go out and magic has revived and there are strange creatures all over, and one of them is the grue. Now the grue that he invented is nothing like the grue in *Zork*, but the name is so nice, evoking, as it does, buckets of blood and things like that, that I sort of stole it from him."

Horse

And they keep on breeding, I pointed out.

"Oh yes . . . other than eating adventurers, that's all they do. There was a period when there was a grue in every game. Even in *Suspect*, the murder mystery I wrote, there was a horse named Lurking Grue, but we've abandoned the idea as being a little bit . . . well, precious."

Moving from the history of the grue to the history of Infocom, that was dealt with in some depth in a previous issue of *Your Computer*, and took us as far as the

Mike Gerrard meets Dave Lebling, an Infocom founding father, and they talk about grucs, llamas, leather goddesses, Douglas Adams and Uncle Buddy

commercial release of *Zork I*, though that wasn't quite the instant success you might expect with hindsight.

"*Zork* started slowly," Dave explained. "We were originally distributed by Visicorp, which is the company that also distributed *VisiCalc*, the first spreadsheet program, and they sort of had the feeling that, well, this is a very nice game but games were not very exciting at the time, but we've got this spreadsheet program which is really exciting, and I think that's how they looked at things. So *Zork* started off with what games sold then in the United States when they were introduced, about ten or twelve thousand copies, and that was pretty much what they expected so they weren't terribly interested in pushing it harder so we got the distribution rights back from them and started distributing it ourselves. We repackaged it and because it was our own product we were very motivated to make it a success and it began to pick up from that time. It had got spectacularly good reviews but they weren't always translated into sales, but as time went on we got it onto different machines, and that helped."

"Also, all people had seen then were the Scott Adams adventures and *Colossal Cave*, and *Zork* was bigger, more complicated, more realistic, had a better parser . . . from a grubby marketing point of view there were a lot of good sales



Leather: scratch and sniff card

points, and then we came out with *Zork II*, which helped even more, and of course we've been turning 'em out ever since."

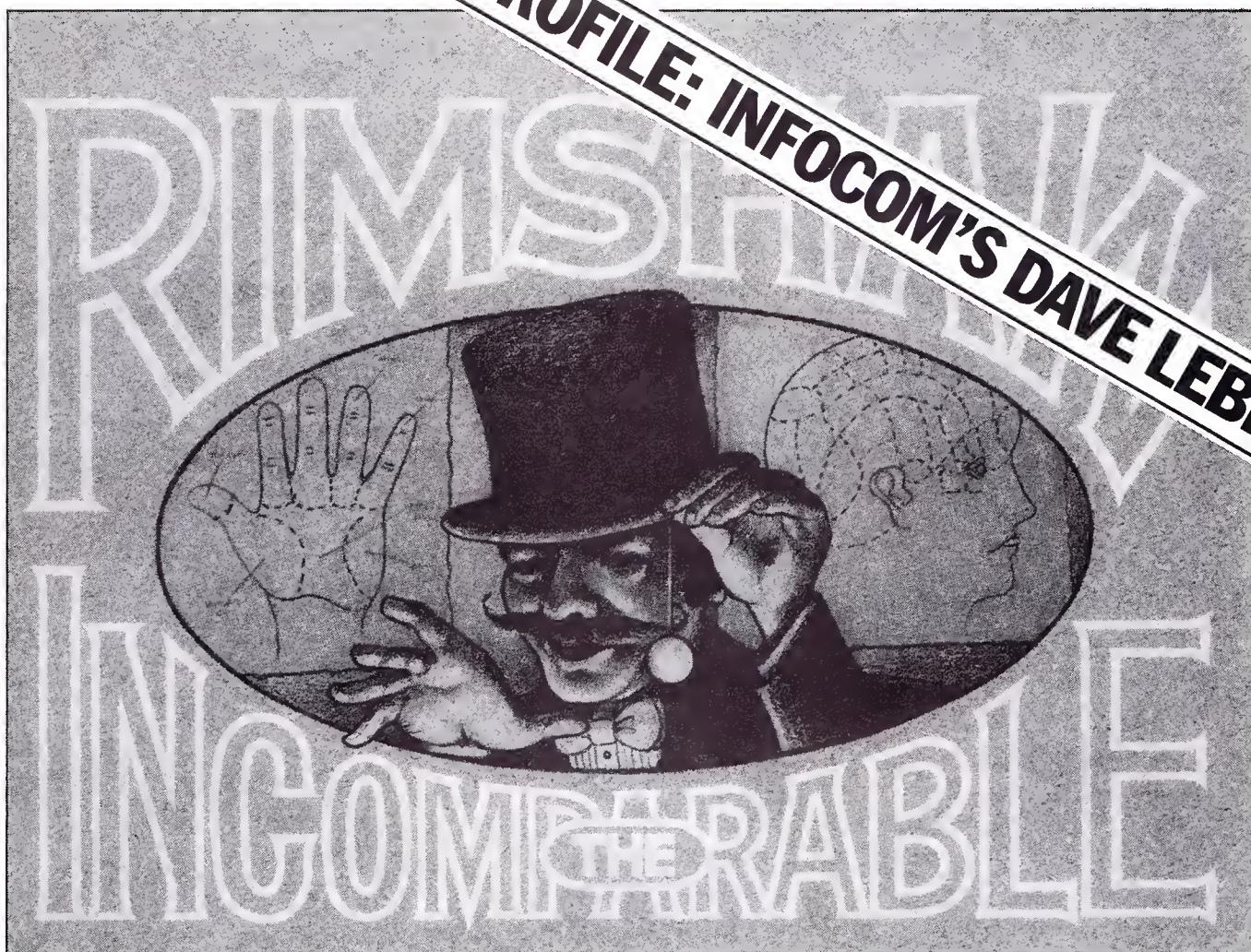
They have turned out so many in the last twelve months, in fact, that players in the UK may have found it quite a strain on their wallets, despite the lower pricing now in evidence. We have seen *Wishbringer*, *Trinity*, *A Mind Forever Voyaging*, *Moonmist*, *Ballyhoo*, *Leather Goddesses of Phobos* and now *Hollywood Hijinx*, which is being followed by the eagerly awaited Douglas Adams game, *Bureaucracy*. Eight games in a year?

Bizarre

"Well the reason for that is partly because we've been getting better distribution over here. *Wishbringer* and *A Mind Forever Voyaging* came out in '85 in the States, the others in '86, and *Bureaucracy* is the first of our '87 titles. We tend to put out between four and six games a year, and sometimes it takes them a little longer to get over here for reasons which are usually totally bizarre. We're getting them faster over here than we used to, and that is partly because of Activision, and I think one of the reasons is that the older ones that were coming through slowly pushed up against the newer ones that were coming more quickly."

I had wondered if what had seemed like

PROFILE: INFOCOM'S DAVE LEBLING



Ballyhoo: Rodney Rimshaw from the coast of Cornwall stars in The Travelling Circus That Time Forgot

an increased production rate might cause problems in the debugging and checking of Infocom games, as the latest release, *Hollywood Hijinx*, sports one or two spelling and other mistakes, not normally associated with Infocom products.

"We do check them very carefully, but part of the reason for the spelling mistakes . . . I'll tell you this and then you can decide for yourself whether you want to print it or not . . . is that the author, Dave Anderson, is a *terrible* speller. The fact that you've only found two so far is staggering! He's very funny and a very clever guy, but he is not the world's greatest speller. The games do spend many months in testing, both internally at Infocom and with outside testers, and then about a month before the game's ready to be finished someone, and it's often John Palace who is the manager of the Interactive Fiction group and is an ex-editor, reads through the games and looks for spelling mistakes.

"In fact the two in *Hijinx*, 'renowned' and 'marroading', somebody encountered just the other day before I left. Lately we've been running these marathons where we get teams of students together and they play a game till they finish it. They're very good and tend to start at six o'clock on a Friday evening and they'll play as long as 24 hours. Sometimes they bring tents and sleeping bags, and one of the recent

marathons was on *Hollywood Hijinx* and someone noticed the mistakes there.

"Spelling mistakes are actually pretty rare, but almost every game we've ever produced, we've discovered after the release that there is at least one fatal bug in it. Some of them are enormously obscure, and the average player will never find one, but they creep in and of course we always correct them next time the disks are ordered. We've now gone through five, six, possibly seven releases of *Zork* including two major renovations. In the most recent one, for example, I upgraded its parser to our current standards of quality, and that's for *The Zork Trilogy* package."

Compression

I asked Dave if the ever-expanding memories of home micros meant there was less need to put effort into finding ways of compressing text, and instead they could concentrate on improving the parser.

"Oh no, we're always looking at things. Actually, compressing the text and improving the parser work oppositely. Improving the parser invariably means you make the game bigger so you have to compress the text further. Even the bigger games we end up trying to compress, like *Trinity*, *Bureaucracy* and *A Mind Forever Voyaging*. Now we have this larger system

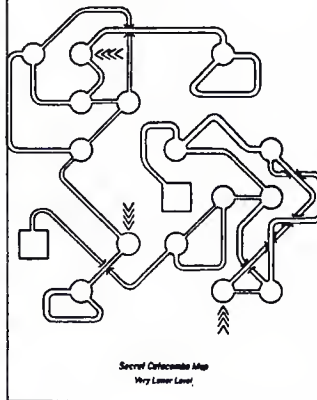
that will go up to 256K, and of those three titles, two used all 256K, and with the third one only time prevented it from doing it since it was growing like a yeast.

"We have a program that goes through looking for frequent words and compresses the most frequent into a single character. Another program goes through looking for frequent phrases, like "Only an idiot would try to . . .", and the program ranks them according to how much space combining every instance of each phrase would save. I think we spend far too much time trying to make characters work better."

But is there such a thing as the ultimate parser?

"Well, we, talking now, are the ultimate parser, but in computer terms I think to parse as well as can humans, a computer would have to be truly artificially intelligent. However, to parse much better than existing parsers parse, I don't think a computer would have to be that much more clever than it is now. We're working on better parsers. I know Magnetic Scrolls, who I went to see today in fact, are working on a better parser. There are lots of people looking at ways of making games more realistic in that way: better parsers, better characters, better thieves, better trolls and things like that. We have a good friendly rivalry going with Anita Sinclair and Magnetic Scrolls. We'll make helpful ►

ADVENTURE PLAYGROUND



Leather Goddesses: map

► comments like: 'You call that a parser? It's nothing but a stinking heap of . . .' But *The Pawn* is the most Infocom-like game I've seen, and they do very nice stuff."

It's not just the quality of Infocom's adventures that sets them apart from any of their rivals, though, but also the packaging that comes with them. Who could resist the Scratch 'n' Sniff card from *Leather Goddesses*, the genuine piece of pocket fluff in *Hitchhiker's*, or the signed photo of Uncle Buddy in *Hollywood Hijinx*, the movie director responsible for such classics as *Vampire Penguins*?

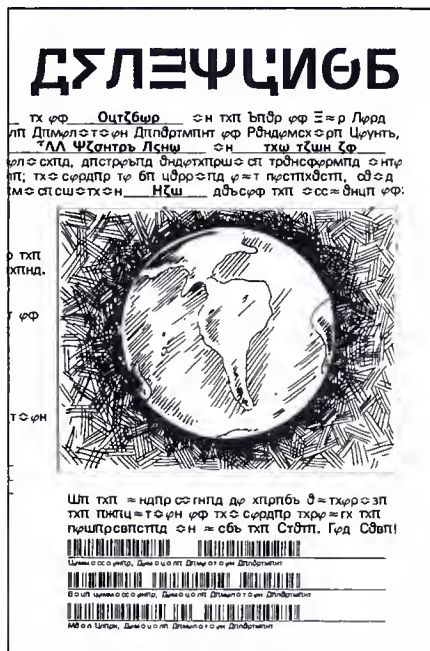
Nickname

"The story behind Uncle Buddy is funny," says Dave. "The game was written by Dave Anderson, whose nickname really is Hollywood, and he went with the guy who designs our packaging to this stock photo shop, a place where they have thousands and thousands of photos that you can use without worrying about copyright, and they sifted through hundreds of these photos and they could not find anyone who looked appropriate for the character of Uncle Buddy. So when they got back to Infocom, Hollywood said: 'Now I don't want to insult the guy, but the guy who runs the photo store, that is Uncle Buddy.' So we went back and approached him and he thought it was wonderful. We decked him out even more garishly than he would normally be decked out, took the photo . . . and the answer to what must be your unspoken question, that is truly the man's real hair, it is not a toupee!"

Transcripts

Had elaborate packaging been one of Infocom's ideas right from the start?

"Well the first packaging of *Zork* was just the disk and the manual, very prosaic, and the first one that had really exciting packaging was *Deadline*, the first murder mystery we did. We had seen some things by Dennis Wheatley, I don't know what sort of books you'd call them, but they had clues, transcripts, all kinds of fun stuff in them, and I think it was Mare Blank seeing those things that motivated him to write *Deadline* and so we got the idea that it would be fun to have interesting stuff in our packaging too. It was such a success, and partly for that reason as well as being a good game, that the next time we did a game we thought, well, we can put some



Hitchhiker: silver alien document

other keen stuff in, and so we've just made a habit of it.

"Sometimes, also, it incorporates anti-piracy elements, things like the wheel in *Sorcerer* that is hard to reproduce. The little details add to our fun, too, we spend a lot of time sitting round saying 'What should we do?' We had enormous fun coming up with the gossip paper in *Hollywood Hijinx*, it's totally bizarre. Actually our own criticism of it was that it wasn't outrageous enough, it wasn't that much more bizarre than a real gossip paper."

The only Infocom game so far that has been an adaptation from another medium has been *The Hitchhiker's Guide to the Galaxy*. I wondered if this was the start or a trend or whether Infocom games would always be original adventures.

Milliseconds

"The major requirement we have on outside collaboration is not just 'Can we buy a licence to do it,' but rather in the way we did *Hitchhiker's*: is the author someone who's interested enough in the medium to want to work with us directly? We don't like to go off and buy some property just so we can slap that name on the package, we much prefer to have the outside person say, as Douglas did: 'This is a very interesting medium and I'd like to try to do something with it.' Then we usually mull it

over, and in the case of *Hitchhiker's* I think we mull it over for about three milliseconds.

"As for any books we might do in the future, I have to give our stock answer to that which is that we don't publicise products more than about six weeks before they're released. But having said that, the obvious next thing to do would be *The Restaurant at the End of the Universe*, and there's always the possibility that that might happen. I had dinner with Douglas last night, in fact, and we talked about lots of things, including his new novel, of which he alleges to have just actually finished correcting the galley proofs yesterday, and he was at last free of it. He looked a tad haggard."

Paranoid

As it's close to the release of *Bureaucracy*, however, perhaps Dave can tell me what that's about instead.

"What's in *Bureaucracy*? What isn't in it? It's got the Zalagasan National Airline, it's got Rambo-like paranoid schizophrenics, it's got your bank, it's got Ronald Reagan and Mr Gorbachev, it's got llamas, it's got the Boysanberry Computer, it's got the Zalagasa User's Group on the Boysanberry Computer . . . it's a very very strange game and is hard to describe, much harder than *Hitchhiker's* and imagine trying to describe that. With that game you could say: 'Well, it's sort of like the book, except different.' With *Bureaucracy* you could say 'Well, it's sort of like the book of *Bureaucracy* except different and there isn't a book in the first place.'

Shambles

"It starts when you move to take a new job, and you send a change-of-address card to your bank, which promptly does what banks always do with that sort of thing, which is to throw it away, and as a result your entire life begins to collapse into a shambles of total uselessness and you basically have to acquire the means to extricate yourself from this situation of having no money, your mail going to the wrong address, your credit cards cancelled, your computer not working, all the kinds of terrific things that can happen. One of the people who tested it, who was fortunately in the minority, didn't like it very much and said 'I have enough of this happening at work, I don't want to go home and have it happening on a micro too!' But it's got everything, including the secret headquarters of the conspiracy that masterminds the whole thing . . . I'm not sure grues actually made it, though in fact grues are instrumental in the conspiracies against all of us."

As if eating adventurers wasn't bad enough! Dave Lebling, what have you done?

● pages 48, 49: *Hollywood Hijinx*.

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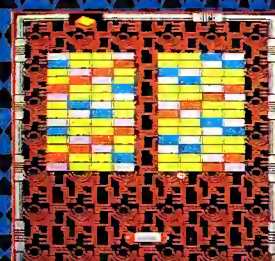
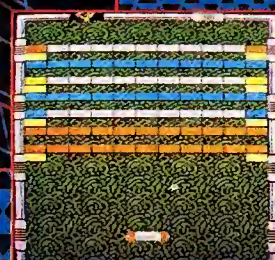
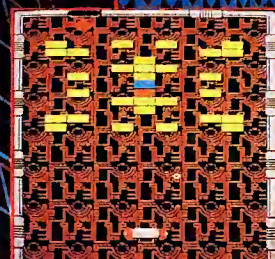
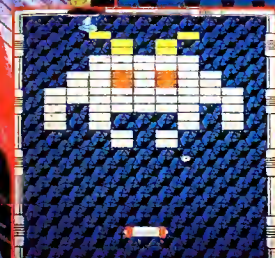
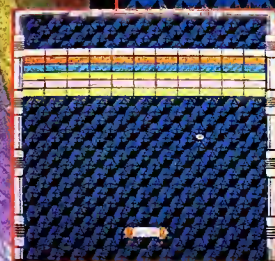
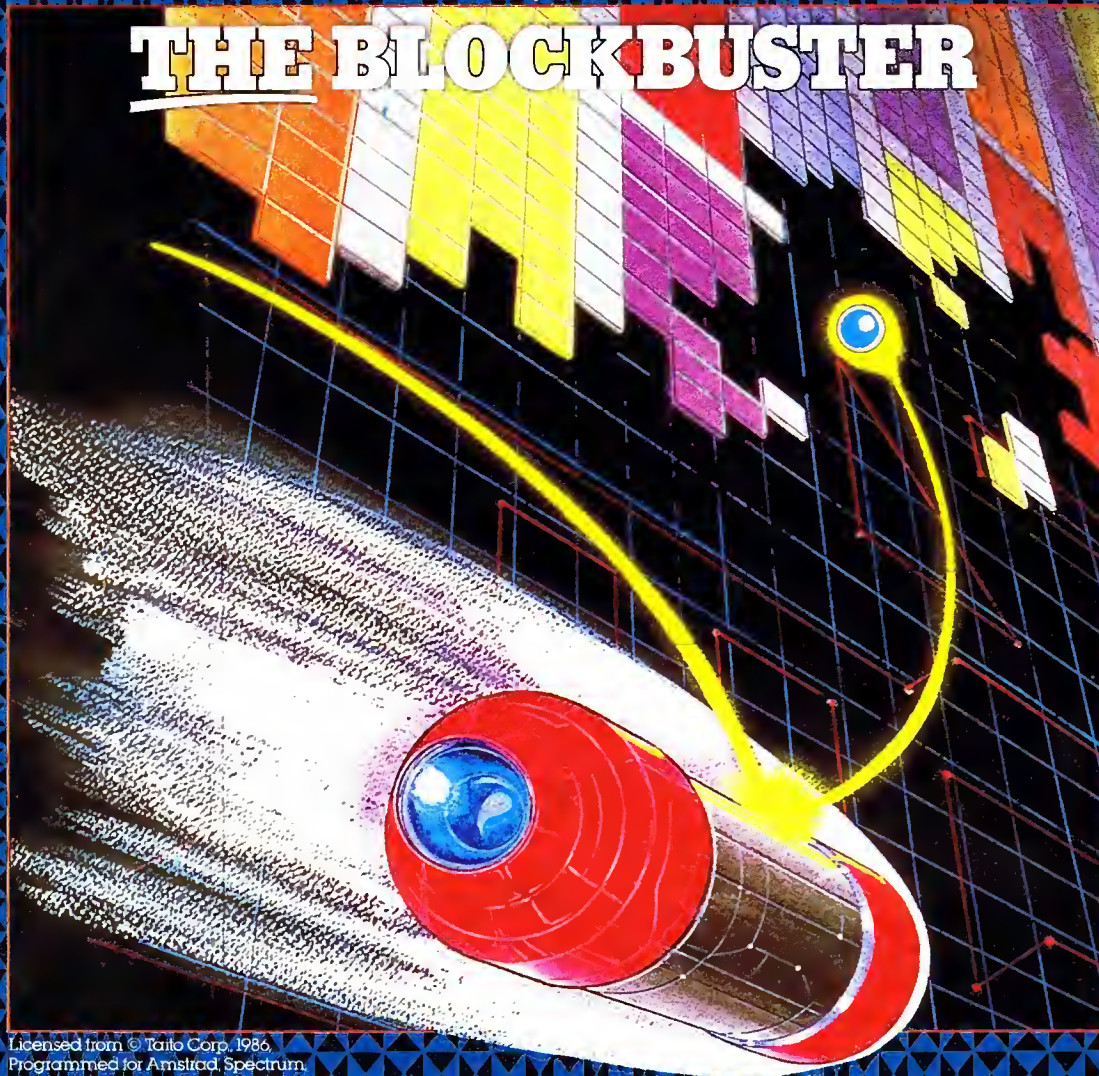
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Hanover seems an unlikely place to hold the world's largest information technology fair, but it makes sense when you think about it. Not only is Hanover near the geographic centre of the western world, halfway between the clone factories of Taipei and the development centres of California's Silicon Valley, but West Germany is one of the most enthusiastic consumers of information technology.

There is so much technology on show at Hanover that even the most hard-bitten techno-bug cannot fail to be impressed by it all. Imagine if you can a huge exhibition site with 17 halls – varying in size from being at least as large as Alexandra Palace to offering more space than London's Olympia.

It was in those halls that I saw for the first time some intriguing new offerings from the likes of Atari, Commodore and Apple, all of which will have an impact on

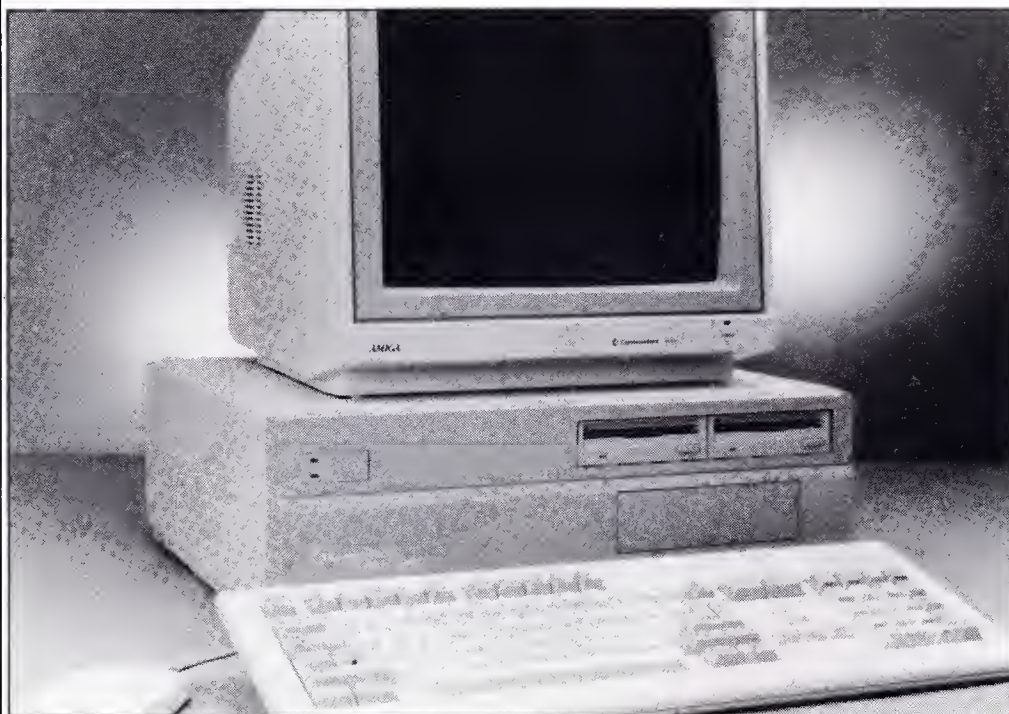
The surprise launch – that of the Macintosh SE – is obviously a move to answer some of the criticisms levelled at the existing Macintosh range and to integrate the Mac in the more flexible computing environment towards which Apple is currently working.

The £2,495 SE machine will be supplied with two floppy disk drives internally, 1Mb of computer memory (with room for a good deal more) and a choice of keyboards.

According to Apple's UK Macintosh product manager, the SE is an important development for all watchers of the Mac and the popular WIMP (Windows, Icons, Mouse and Pointer) environment that goes with it. 'The SE has a compact design like that of the Macintosh Plus and maintains full compatibility for all available Macintosh software,' the company claims. 'The focus of the Macintosh SE is on ease of learning and use and a highly

HA HO

Geof Wheelwright
show and finds a crop
machines based



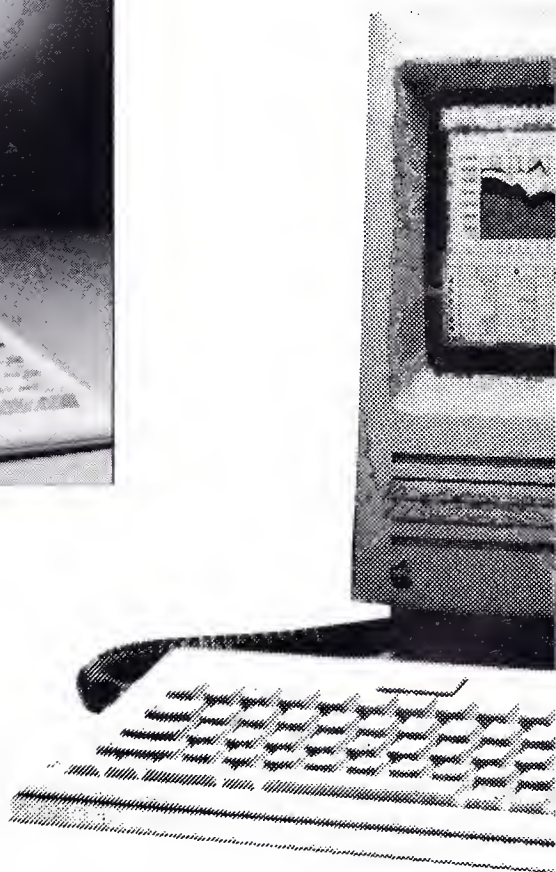
the UK micro scene. Not all the machines were actually launched at the show itself – the Atari had been shown a month before in the US and the Apple was launched worldwide a few days before Hanover – but they all made their European debuts there.

The Macintosh SE, a faster, beefed-up version of the existing machine, and the Macintosh II (a much larger machine with room for expansion cards – which allows for greater flexibility and expansion of the system) were unveiled at a worldwide launch that ran simultaneously in the US and the UK and then shown in Hanover the following week.

A new Macintosh had been expected from Apple for some time, but few were expecting the company to launch two new machines at the same time. Now the details are out, however, it is not hard to see why it has done so.

● **Above: the Commodore Amiga 2000 with bolt-on PC compatibility**

evolved design to give substantial expandability options to users. Everyday business needs will continue to be served by the Mac Plus and Macintosh SE will serve the needs of those users requiring the flexibility of a built-in expansion path.'

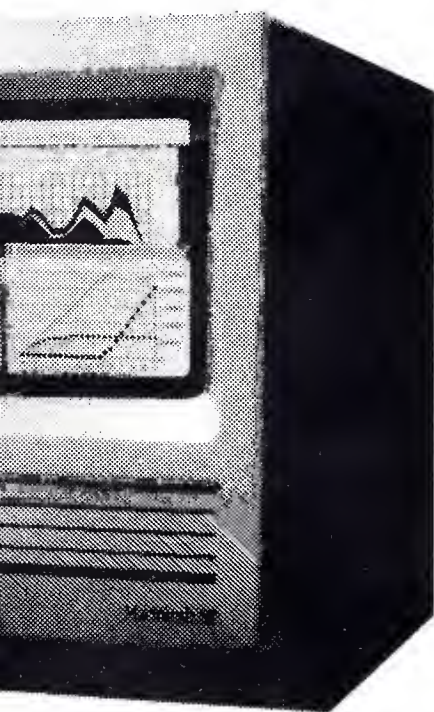


NO VER RIZONS

**visits the annual Hanover
of new high-performance
on the Motorola 68000**

One of the most important routes on that expansion path is provided by a new Mac expansion slot, which can be used for devices such as an MS-DOS card with an 8088 co-processor, which would allow the Mac to run PC software, network cards, video outputs and processor accelerators. The SE is also faster than the existing Mac Plus, achieving the speed increase via special new ROMs. The SE is the first of the new Mac machines to reach the market and went on sale in Apple dealers in March.

It will not, however, replace the company's existing Macintosh 512K and Macintosh Plus computers – although Apple does admit that sales of the former machine are soon likely to fall to such a



- **Above: the Atari rival – Commodore's £499 Amiga 500. Left: the go-faster Macintosh SE**



small share of the Mac market that it may be discontinued.

In the long term, though, it is the Macintosh II – or 'Open Mac', as it was dubbed during the long development phase for this machine – that will really make a difference for Apple.

In the Macintosh II – a machine with a starting price of less than £5,000, a new Motorola 68020 processor, room for hard disk storage devices, abundant memory and display options including colour – Apple now has a machine which can effectively compete with the new breed of IBM PC-compatible computers based on the Intel 80386 processor.

Unlike the 80386-based computers released by Compaq, Zenith and IBM, the Macintosh II will not have to wait for a new operating system before it can be used to full capacity. The Macintosh II will handle more than 100 megabytes of memory while the ageing IBM Personal Computer operating system is still limited to 640K – slightly more than half a megabyte. It also handles hard disk storage of more than 40Mb and can even use a co-processor card that allows it to run computer software written for the IBM machine.

Despite the obvious power of the

would be worth offering even if it does have the same amount of memory.

Reworking of the circuit board has introduced an Atari expansion slot for proprietary expansion cards and a battery-backed clock and proper DMA interfacing for the planned Atari laser printer and improved hard disk. But the major differences are in the cosmetics. These include taking the main circuit out from underneath the keyboard and moving it into its own housing, putting an internal disk drive inside that housing and moving the connectors to the back. Freed from the CPU, the keyboard is detachable and features the same layout as the existing 1040STF.

The other non-cosmetic difference of note is the inclusion of a blitter chip set inside the Mega ST, which allows much faster manipulation and display of graphics. This will make it an excellent choice for desktop publishing, animation and games.

Neatly

In the peripherals field, Atari has redesigned the SH205 20Mb disk drive for the Mega machines, so that it now sits neatly sandwiched between the monitor and the CPU. As mentioned earlier, it also makes use of the improved DMA interfacing

Atari TOS graphics as well as feature a Diablo 630 printer emulation.

Atari's arch-rival Commodore, however, was not going to let the Tramiels steal all the limelight and made a big splash with the new Commodore Amiga 2000 and Amiga 500 models – as well as some new PCs. The latter included a high-end AT-compatible which seemed to be very well received by the German business market and a low-end, entry PC called the PC-1. The PC-1 is not a machine the company's former UK managing director Chris Kaday was likely to bring to the UK in a hurry, but if it succeeds in Germany his successors may have to revise those plans.

The Amiga A500 employs the Motorola 68000 CPU and the three-chip co-processor set (unaccountably described in the press release as a "word-processor system") first seen on the A1000. 512K is the standard allocation of RAM, with the possibility of internal expansion to 1Mb. The built-in disk drive gives 880K of storage. At £499 the cost of the entry-level Amiga is still substantially more than that of the Atari 520 STF since the Atari has a high-resolution monitor thrown in.

The other new Amiga is the up-market A2000, starting at £1095 for a 1Mb machine with one 880K disk drive. The advantage of the A2000 over the A500 is its expandability to include a 20Mb hard disk drive and up to 8Mb of internal RAM. Commodore sees the A2000 as a way into the increasingly important workstation market, especially in such areas as CAD/CAM and process control. To mollify conservative corporate buyers who place PC compatibility high on their list of desirable features, A2000 buyers can specify a £299 8088 processor board. An optional 5¼ inch disk drive lets users with a big investment in PC software run their programs without tedious file transfers between different disk formats.

Sense

It is sad that this is apparently necessary for corporate acceptance. On a technological level it makes about as much sense as transplanting a Cortina engine into a Ferrari. Nevertheless, if the upgrade path from MS-DOS provided by the 8088 processor board gets the Amiga on to the desktops of business users, it will be entirely justified.

The level of PC compatibility provided is said to be excellent, with even the tricky Microsoft Flight Simulator running happily. Of course, anyone with an Amiga should buy Sublogic's superlative Flight Simulator II in its dedicated Amiga form, but if the PC version runs then other favourites such as Lotus 1-2-3 should be equally satisfactory.

The A500 shares with the A2000 an upgraded keyboard with improved feel and key spacing.

► Macintosh II and the competitive position it could occupy against the new breed of 80386-based IBM Personal Computer clones, Apple claims that it does not yet see the machine as its mainstream desktop business computer. It will not be shipping the machine until July and still expects the Macintosh Plus and Macintosh SE to make up the bulk of its sales.

A similar attitude seems to be taking hold at Atari, which showed its new Mega ST and Atari PC products in Europe for the first time with the message that it is the



● **The 68020-based Apple Macintosh II**

Mega ST it wants to concentrate on for the moment. While the company's new IBM-compatible machine is getting a good deal of attention (particularly in the US where it has stolen the thunder from the Amstrad PC1512) it is the Mega ST which will have a longer-term effect on the company's entrenched ST products.

Conflict

The Mega ST is supplied in three versions, each largely defined by its memory capacity. They are the Mega ST1 with one megabyte of RAM, the Mega ST2 with 2Mb and the Mega ST4 with 4Mb.

Although Atari UK has been unsure whether or not to offer the ST1 in the UK (it might conflict with the existing 1Mb Atari 1040STF), the Mega range has enough additional features over the standard system that the 1Mb system

ing on the Mega ST.

As for the planned Atari laser printer, which was on show in Hanover in a decidedly pre-production form, we can certainly look forward to a low price for this machine as Atari has designed the Mega series of machines to share some of the work normally carried out by the printer itself. Most laser printers include their own processor and RAM, while the Atari design allows its laser printer to share those facilities with a Mega ST and still produce high-quality work at some eight pages per minute.

There was not a great deal of information available in English about what the Germans call the Atari SLM Laserdrucker, although I was able to glean that it will offer the aforementioned eight pages per minute print speed, 300 dots per inch print resolution and will support standard

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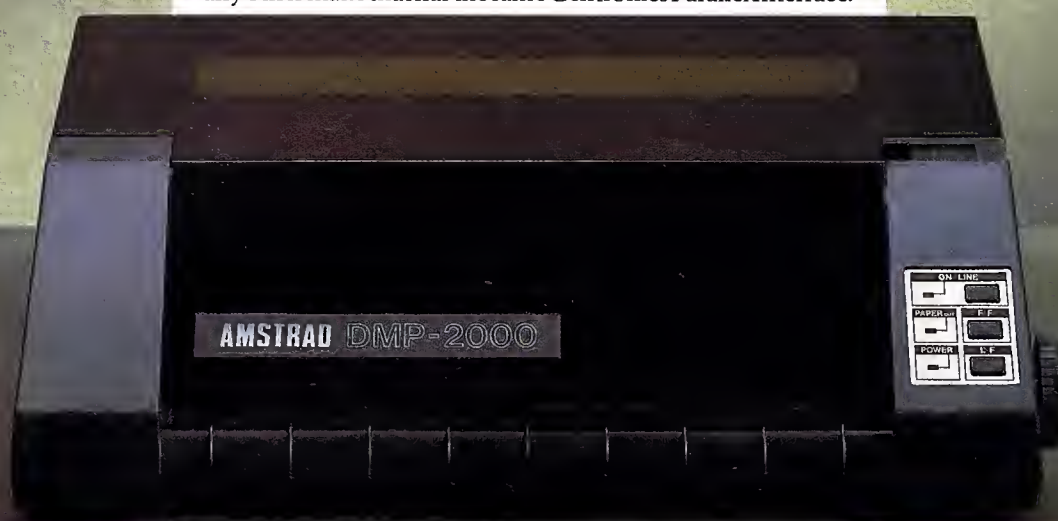
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TAKE OUR WORD

Paul Hendy has been busy testing a dozen word processing packages on five of the top computing systems available in the UK. Here are his conclusions . . .

WORDWISE-PLUS

(C) Computer Concepts 1984

- 1) Save entire text
- 2) Load new text
- 3) Save marked text
- 4) Load text to cursor
- 5) Search and Replace
- 6) Print text
- 7) Preview text
- 8) Spool text
- 9) Segment menu

ESC Edit Mode

Please enter choice

• Wordwise Plus: unveils on the BBC with this opening screen.

Mention the names BBC, Amstrad and Atari, and you have probably caught the attention of most of the home computing public in Britain. Mention word processors, and a multitude of products are thrown at you, each guaranteed to be the finest thing since striped toothpaste. Although I own 23 word processing packages I seldom use more than one or two on each machine. I hope this article will stop people cornering me at parties to ask which is best!

BBC

There are in my view two serious contenders on this machine, Wordwise Plus and InterWord, both designed by Computer Concepts. The former is now getting on in years but well over 150,000 were sold so it still has an avid following. Its big advantage is the built-in programming language which enables users to write their own routines to handle business requirements like mail-merging, label-printing, as well as text editing operations. Third party software houses have produced ROMs using this WPPL language covering almost all possibilities, thus circumventing the limi-

tations of the word processor itself. In addition to the main memory area, there are ten 'segments' which can hold text or programs written in WPPL.

It is not WYSIWYG (what you see is what you get) so the screen does not look anything like the final printed version. Instead 'embedded commands' are inserted into

the text which control page length, line spacing and printer codes. It is able to use the brilliant new Spellmaster ROM from the same company, thus fulfilling most requirements. Depending on the amount of memory remaining, you can check the final format in 'Preview' mode, but the BBC B, with only 32K of memory, is looking rather meagre in comparison with its big-memory brothers. Add-on boards like the Watford 32K unit enable previewing to take place no matter how much text is in memory.

InterWord on the other hand is positively bulging with features. Drop down menus are included, and they are used extensively to offer multi-file processing, control of any printer, spell-checking, and onscreen illustration of bold or underlining attributes. Once more the limitation is the memory of the BBC B, hence the multi-file option which breaks down long documents into shorter pieces, yet still treats them as an integrated whole. Imitating the concept of segments, you are able to hold up to 16 Inter packages in memory, provided you have the appropriate ROMs these can be charts, databases, spreadsheets, or documents. It is probably the

• Protex from Arnor: looks like this on the PCW with a help menu turned on.

released LogoSpell and LogoMail for spell-checking and mail-merging, and they too have all the standard features one would expect from an integrated system, but the nagging problem of slowness still remains.

The option to create ASCII files (in other words files with no special codes in them, able to be read by most systems) was welcomed by many people. This meant that fields prepared in Locoscript could be transferred to other word processors, and other computers by using the RS232 interface and appropriate software. Locoscript2 is rumoured to be just over the horizon, and this promises to be faster, though it is going to need to be turbo-charged with go-faster stripes to shake off the Locoscript snail reputation.

Arnor have just released Protex CP/M for the PCW, reviewed recently in this magazine, and it is a superb word processor, it has just about everything one could ask for in a system that does not use drop down menus and mouse. There are two schools of thought as to which is better, and I think there are good arguments on both sides, provided the mouse and windows operate quickly. This article is being written using Protex and it is a delight to use.

PRINTER CODES	ON n (n)	output codes	PE ON	print even pages
CW n	char width (n)	PD ON	print odd pages	
CC	control code	MC n (n)	microspace code	PF ON
R n (n)	relative char	MS ON OFF	microspacing sw	proportional printing

• Back to the Beeb: drop-down menus with Wordwise Plus.

Words-535 Characters free-19542 I Pen-Friend? (c) Paul Hendy 1986

a) Printer codes
b) Embedded commands
c) Embedded values
d) Address pointers
e) Format page
f) Function keys
g) Auto-load file
h) Auto-save file
i) File saved check
j) Multi-column
k) Label printer
l) Display segment
m) OS commands

The routines are letter, doubled stored as AA, a

2) The use of drop-down windows in M+ means that much helpful information can be displayed as and when required. The principles behind this are very simple, and the program could start something like this:

only truly integrated ROM software system for the Beeb, and its features ensure a strong following for this machine for a long time to come.

Both these word processors are supplied on ROM (chips you plug into the computer making the programs instantly available), so corruption is virtually impossible.

CPC 6128

The Amstrad CPC 6128 is also capable of accepting ROMs, a fact well exploited by Arnor with a set of three called Protex, Prospell, and Promerge, so once more there is the ability to enter the word pro-

FOR IT

cessor without first having to find a disk. An add-on box is needed for the computer to accept ROMs, but it is worth it.

The word processor itself is well designed, friendly, fast, and has all the standard features one would expect and many that are normally found only in much larger and more expensive packages. The CPC 6128 is also capable of running programs under the CP/M operating system, which lets in the big boys, NewWord and WordStar.

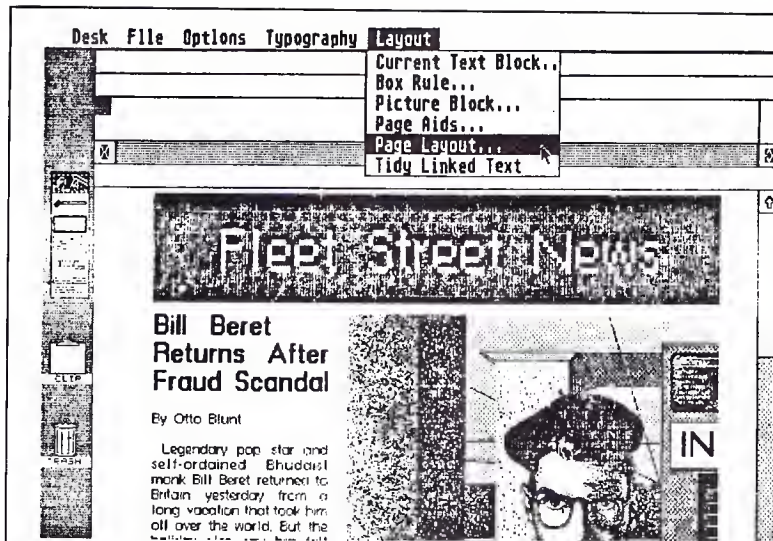
PCW 8256

Many owners of the PCW have settled quite happily with Locoscript and for short documents it is ideal, with drop down menus, excellent printer control including proportionally-spaced right justified text which is normally very difficult to achieve. The designers, Locomotive Software, have released LocoSpell and LocoMail for spell-checking and mail-merging, and they too have all the standard features one would expect from an integrated system. One nagging problem is the slow response of the program.

The option to create ASCII files (in other words files with no special codes in them, able to be read by most systems) has been welcomed by many people. This means that files prepared in Locoscript could be transferred to other word processors, and other computers by using the RS232 interface and appropriate software. Locoscript 2 is just over the horizon, and this promises to be faster, though it will need to be turbo-charged with go-faster stripes to shake off the Locoscript snail reputation.

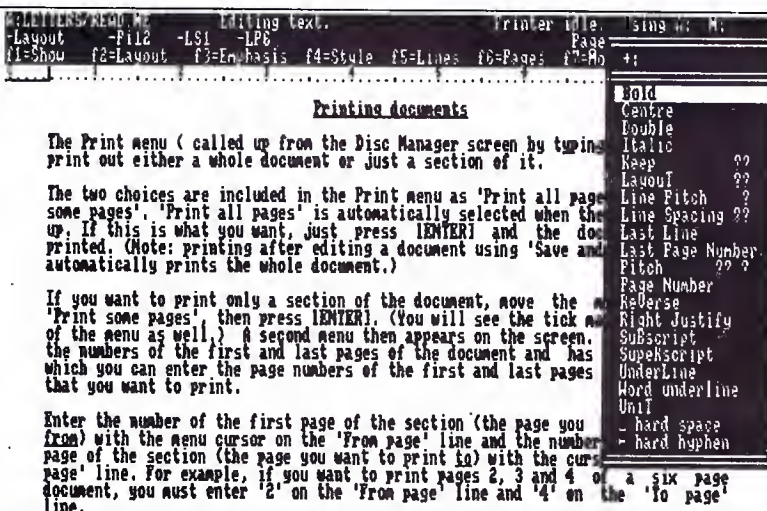
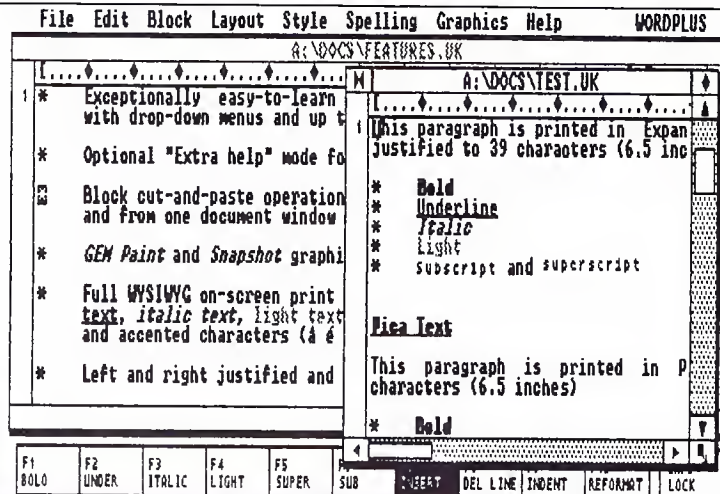
Armor has just released Protext CP/M for the PCW, reviewed recently in this magazine, and it is a superb word processor. It has just about everything one could ask for in a system that does not use drop down menus and mouse. There are two schools of thought as to which is better, and I think there are good arguments on both sides, provided the mouse and windows operate quickly. This article was written using Protext and it is a delight to use.

Two documents can be held in memory at the same time, and the program has the ability to run small sub-programs (called EXEC files) which can perform a wide variety of functions. Mail-merging and spell-checking functions are built in, and there is even the option to copy files and format disks without leaving the program or losing the file in memory - ideal for those who have prepared a long document but then encountered the dreaded 'Disk Full' message.



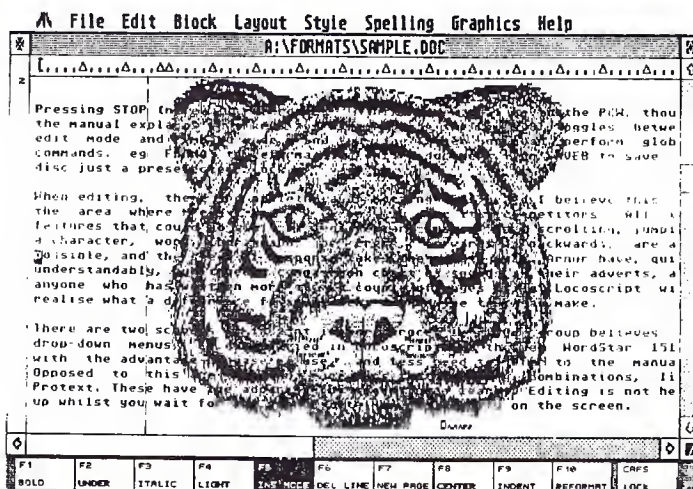
- On the Atari ST: Fleet Street Publisher (see separate review elsewhere in this issue).

- 1st Word Plus: handling two documents at once on the Amstrad PC 1512.



- Locoscript on the PCW: showing a drop-down menu.

- Text and graphics together: on the Atari ST.



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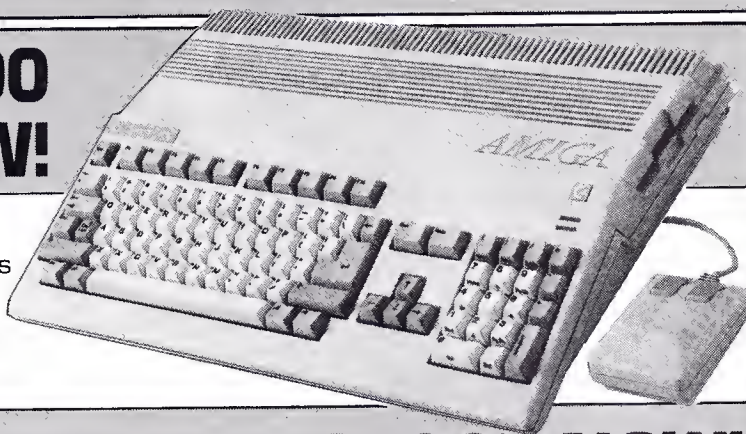
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WordStar and NewWord are also available for the Amstrad range. NewStar has done a deal with MicroPro, who suddenly bought out the competition, to ensure that NewWord 2 is still available. These are industry standards, and so much has been written about them it is not worthwhile duplicating it all here. Drop-down menus are not used, but the features included in WordStar set the standard which all other word processors strive to match, and in many cases go beyond. NewWord was written by some ex-MicroPro employees and in many people's minds, WordStar is the standard, and NewWord the almost perfect clone, with many more features! My recommendation is to use Protex or the slightly cheaper NewWord 2.

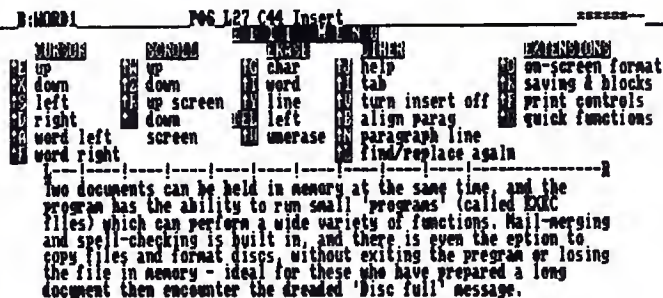
Amstrad PC1512

The Amstrad PC, being an IBM clone, has thousands of software packages available, including word processors that range from the humble to the unbelievable where you think of a number and multiply by 100 to get the price. Having 512K of memory means that software writers produce enormous programs, probably using 100K to generate a syntax error (by comparison Wordwise Plus is just 16K of machine code). However this much memory opens up the world of 'desk-top publishing', the ability to mix text, graphics, various fonts in various point sizes and gradually the division between publishing and word processing is disappearing.

The sadly lamented NewWord 3, bought up by MicroPro, is still available if you want to pay hundreds of pounds for it (it was cheaper before), and was like WordStar, again with more features. If you can get a second hand package it is worth haggling for. MicroPro has released Version 4 of WordStar, rumoured to have most of the NewWord 3 features, and more! (See separate review elsewhere in this issue.)

Never one to miss the opportunity of trying to produce an even better product, William Poel gave me details of NewStar 4 (note the slight change of name) that will be even better! Watch this space, but features will include drop down menus, and mouse control, duplicated by CTRL key commands and control if you prefer. Background printing, to enable you to edit

- New-Word: compare this screen dump with the one below.



Two documents can be held in memory at the same time, and the program has the ability to run small 'programs' (called DOC files) which can perform a wide variety of functions. Mail-merging and spell-checking is built in, and there is even the option to copy files and format discs, without exiting the program or losing the file in memory - ideal for those who have prepared a long document then encounter the dreaded 'Disc full' message.

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at the same time. Macros, able to perform a number of tasks by a single keypress. Menu of printers (always one of the bugbears of WordStar), indexing, alphabetical sorting, use of colour (or shades of grey) to show bold, underlining, multi-column editing, spell-checking and mail-merging.

Thus the battle between these two heavyweights in the wp market is set to continue for some time to come. WordStar 4 was due out at the end of March, and NewStar 4 in April. Keep your head down while the flak flies, then read the objective reviews!

One criticism of the Amstrad PC is the speed of GEM. It is slow, particularly when compared to the superb Atari ST, with its superior monitor, and GEM in ROM (ie it doesn't have to be loaded via blue and green disks!). The Atari was released with a free word processor, 1st Word, and the software house responsible, GST, always had plans to produce a 1st Word Plus. This has also been made available for the Amstrad PC, and if you like GEM, this is the one for you. It is packed with features, including spell-checking and mail-merging and it doesn't scold you by devouring your text at the first possible opportunity! The Install routine even sets up a GEM boot disk to save you having to swop between the blue and green disks every time.

Oscreen bold, underlining, and italic are available, but these are let down somewhat by the Amstrad monitor, particularly in mono. Graphics can be included, and loaded from a variety of sources, including GEM Paint. But of course once you include graphics, you limit the printout to dot

matrix, of lesser text quality than a daisywheel. Which word processor to recommend is difficult because of the plethora of choice. If you want GEM and mouse control, then use 1st Word Plus. If you like WordStar compatibility, then use NewWord 3 if you have it, or can get it cheaply. Otherwise wait for the NewStar 4/WordStar battle and pick the winner!

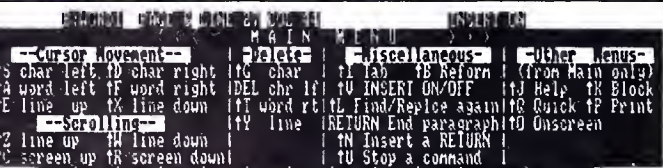
Atari ST

On the Atari ST, I believe that 1st Word Plus reigns supreme. Here the slowness of GEM is no longer a problem, and the speed can be breathtaking at times. Massive documents can be held in memory at one time, and the enormous dictionary supplied as part of the spellchecker has just about every word needed. Up to four documents can be held in memory at the same time and text can be transferred from one document to another. Cut, paste, copy, and delete blocks are all provided by drop-down menus, and the ultra high resolution mono monitor makes the inclusion of graphics a joy to use, and is easy on the eyes.

On screen bold, underlining, italic, and light (used for special effects, for example, colour ribbon on a daisywheel, and mail-merging) are all displayed correctly, along with superscript and subscript, on the WYSIWYG layout. Many of the mouse's cursor and editing functions are duplicated by CTRL key combinations for those who do not like having to take their hands off the QWERTY keyboard.

This lightning dash through word processors can only serve as a personal guide through some of the systems available at a relatively cheap price for the home market.

All the packages either come with, or include as optional extras, spell-checkers and mail-mergers. For Wordwise Plus the spell-checkers are from third party sources - Spellcheck III (Becbug) or Rom-Spell (Watford Electronics) - as are the mailmergers (same companies). ROMs using the W+ programming language are Word-Ease (Beebug), Word-Aid (Watford Electronics), CP-ROM (Norwich Computer Services) and Pen-Friend 2 (Paul Hendy, that's me, at PO Box 67, Wolverhampton, West Midlands WV10 9HG)



Two documents can be held in memory at the same time, and the program has the ability to run small 'programs' (called DOC files) which can perform a wide variety of functions. Mail-merging and spell-checking is built in, and there is even the option to copy files and format discs, without exiting the program or losing the file in memory - ideal for those who have prepared a long document then encounter the dreaded 'Disc full' message.

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- Word-Star: spot the differences with New-Word.

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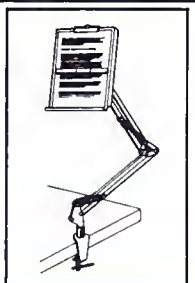
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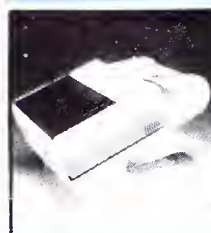
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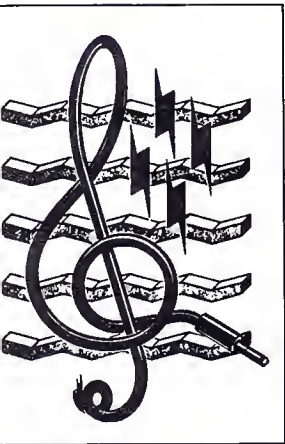


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with Richard Sargent's
exploration of its
tunefule capabilities**



Close to the heart of the three Amstrad CPC computers and the Spectrum 128 and Plus Two lies a music chip called a programmable sound generator (PSG). This chip has been around for some years, but it has proved itself in many computers such as the Memotech, MSX and Einstein ranges. It gives three separate channels of sound and one of noise. Its output goes to a small loudspeaker on the Amstrads, and to the TV speaker on a Spectrum. The ability of the latest Spectrums to play music has been well received: the BEEPer of old was a poor substitute for the real thing.

Device

New Spectrum users will already know how to program music from Basic using the PLAY command and this article concentrates on how to program the PSG chip directly using machine code.

The PSG in question is the General Instruments AY-3-8912. It is a 28-pin device containing 15 8-bit read/write registers, the values of which control all the parameters of the sound(s) being produced. Register number 14 is an exception — it's a general purpose I/O port which the Spectrum designers grabbed for RS232/printer/Midi applications and which the Amstrad designers took to read the CPC keyboards. Messing around with this port (set to an INPUT port by both computers' operating systems) can seriously damage your ability to use the com-

puter, so the program given here automatically thwarts any attempt by the machine-coder to program register 14 as an output port.

There is a 60 page booklet about this chip produced by the manufacturer and titled, appropriately, AY 3 8910/8912 *Programmable Sound Generator Data Manual*, but it is hardware-orientated and does not cover programming in much detail. It's useful if you can get a free copy, but don't rush out and buy one. Running the PSG under machine-code control allows every nook and cranny of the chip to be explored. The Spectrum's PLAY command is designed to play the notes of a nine-octave musical scale, so sound effects are difficult to produce.

When the PSG is freed from the clutches of Basic it can become independent — producing a background sound via the Spectrum's interrupt system while another program is running in the foreground.

Hacking

This month's program uses only 72 bytes of machine-code to drive all the PSG registers. A controlling Basic program handles the user input and screen output, so there is no machine-code hacking to be done. Once the program is running it is simply a matter of choosing a register to load, then loading it. The current contents of all the PSG registers are shown on the screen and the constructed

sound is heard as soon as a register has been successfully loaded. This is a learn-as-you-play exercise!

Testing

First, type in listing one, the Spectrum/Amstrad PSG tester. Every time you come to a REM** line, check whether it is a line for the Spectrum *128* or the Amstrad *CPC* and type in whichever is appropriate to your computer. The line numbers should *not* be altered at this stage, so don't use auto line numbering and don't renumber the program. Start the program with GOTO 390. This will load the machine-code bytes into the central RAM of whichever computer you're using, and also save the bytes to the current filing system in use.

After the machine-code has been saved, verified and tested, the Basic lines 400-590 can be deleted if you so wish. Turn the sound up on your Spectrum/Amstrad system and RUN the program. A list of PSG registers 0-13 appears on the screen, with the decimal value of each register's contents. To save you time, register 7 (of which more will be said later) is set to give TONE sound output rather than NOISE sound output, and only channel ONE has been enabled. Thus the value 56 (binary 00111000) is against register 7 and the value 15 (full volume) is against register 8.

Let me clear up a possible confusion now before it drives you mad. General


```

100 REM Spectrum/Amstrad PSB tester
110 REM Remove the relevant REM** lines
120 CLS :DIM W(16):PRINT " PSB TESTBED PROGRAM"
130 FOR N=1 TO 14:LET W(N)=0:NEXT N
140 LET W(8)=56:LET W(9)=15
150 FOR A=0 TO 13:READ A#
160 REM** PRINT AT A+3,1;A;:PRINT AT A+3,8;A#; REM *128*
170 REM**LOCATE 1,A+3:PRINT A;:LOCATE 11,A+3:PRINT A#;'CPC*
180 NEXT A
190 FOR A=1 TO 14
200 REM** PRINT AT A+2,4;W(A); " "; : REM *128*
210 REM** LOCATE 5,A+2:PRINT W(A); " "; : REM *CPC*
220 NEXT A
230 REM** WINDOW #2,1,40,18,20:CLS #2:LOCATE 1,18 :REM *CPC*
240 INPUT " REGISTER NUMBER or SOUND ";A#:IF A#="" THEN STOP
250 IF A#="8" OR A#="s" THEN GOTO 310
260 LET R=VAL (A#)
270 IF R<0 OR R>13 THEN GOTO 240
280 INPUT " DATA FOR REGISTER ";V
290 IF V<0 OR V>255 THEN GOTO 280
300 LET W(R+1)=V
310 LET A=32770
320 FOR X=1 TO 14:POKE A+X,W(X):NEXT X
330 REM** RANDOMIZE USR 32810 : REM *128*
340 REM** CALL 32810 : REM *CPC*
350 GOTO 190
360 DATA "CH A FINE","CH A COARSE","CH B FINE","CH B COARSE"
      "CH C FINE","CH C COARSE"

```

● listing one

```

370 DATA "5 BIT NOISE","00nnnttt","A AMP","B AMP","C AMP"
380 DATA "ENV FINE","ENV COARSE","ENV SHAPE"
390 :
400 REM** CLEAR 32767 : REM *128*
410 REM** MEMORY 32767 : REM *CPC*
420 RESTORE 500: d=490: a=32786
430 LET d=d+10
440 FOR r=1 TO 8:READ v:POKE a,v: LET a=a+1
450 NEXT r
460 IF a<32853 THEN GOTO 430
470 PRINT "Saving e/c to tape/disc..."
480 REM** SAVE "psgmc"CODE 32786,72: STOP: REM *128*
490 REM** SAVE "psgmc.bin",8,32786,65: STOP: REM *CPC*
500 DATA 243,30,255,58,1,128,254,7
510 DATA 32,2,30,63,71,58,0,128
520 DATA 163,87,120,205,71,128,251,201
530 DATA 243,221,33,3,128,221,126,7
540 DATA 230,63,221,119,7,175,221,86
550 DATA 0,205,71,128,221,35,60,254
560 DATA 14,32,243,251,201
570 REM** DATA 197,1,253,255,237,121,1,253,
      191,237,81,193,201: REM *128*
580 REM** DATA 245,74,205,52,109,241,201,0,0,0,0,0,0:'*CPC*
590 DATA 0,0,0,0,0,0

```

```

100 REM Period calculator
110 REM** CLS:LET CK=54687.5:REM *128*
120 REM** MODE 1:CK=62500:REM *CPC*
130 INPUT "Octave -4 to 3 ";OCT:PRINT
140 IF OCT>3 THEN STOP
150 INPUT "Note number 1-12 ";N:PRINT
160 LET V=(2^(OCT+((N-10)/12)))
170 LET P=CK/(448*V):PRINT "period
      value is "P
180 LET C=INT(P/256):LET T=C*256
190 PRINT:PRINT "Coarse value is "C
200 LET F=INT((P-T)/0.5)

```

```

210 PRINT:PRINT "Fine value is "F
220 PRINT "-----"
230 GOTO 130

```

```

PUSH BC      ;preserve BC
LD BC,FFDH   ;select port address 65533(P88)
OUT (C),A     ;write register number to P88
LD BC,BFFDH   ;select port address 49149(P88)
OUT (C),D     ;write data into selected register
POP BC        ;restore BC
RET           ;return to main e/c program

```

● listing two

Instruments labels its PSG registers from 0 to 13 and I have kept this to be in line with their documentation. Register 14 is not listed on the screen since that is the input port and out-of-bounds. However, the Basic program holds the values of registers 0-13 in the array W(1) to W(14). Annoying, but since Spectrum Basic doesn't recognise a zero element in an array we have to live with the array being one step out compared with the register numbering system! In line 140 when you see W(8) and W(9) being loaded, remember it's really PSG registers 7 and 8 which will receive these values.

Prompt

You will also see the first prompt, which is "REGISTER NUMBER or SOUND". Respond with 0 <enter> to indicate that you wish to alter register 0. The next prompt then prints "DATA FOR REGISTER" and you should enter a number; 100 will do. When you press <enter> the W() array is updated with the new data value and the machine-code routine immediately transfers the *entire* contents of W() to the PSG, causing it to sound. Two other responses to the first prompt are allowed. Pressing <enter> on its own returns you to Basic. Typing S<enter> informs the PSG to make a sound using the current contents of its registers. This is useful when you start experimenting with sounds which have a fixed duration, but in the case of the cur-

rent example it will go on for ever. Turn it off by changing the contents of register 0 back to zero.

Each tone channel is software-tuned by a 12-bit number, known as the *tone period*, in the range 0-4095. The 12 bits lie across two registers. The least significant 8 bits, known as the *fine tune* value, occupy an even-numbered register, while the most significant 4 bits, known as the *coarse tune* value, occupy an odd-numbered register. Thus, in your experiments, you will be loading registers 0, 2 and 4 with a number in the range 0-255, and registers 1, 3 and 5 with a number in the range 0-15.

The white noise waveform is software-tuned by a 5-bit number, or *noise period*, loaded into register 6. All these tone period values are turned into sound frequencies by the PSG, but none will appear at the output of the chip unless the amplitude register for each channel is turned on. The amplitude registers (8, 9, 10) hold a 5-bit value, interpreted as follows:

- 0 No sound from this channel.
- 1-15 Amplitude level. 15 is maximum volume
- 16-31 Any number in the range 16-31 switches on the envelope generator.

Experiment

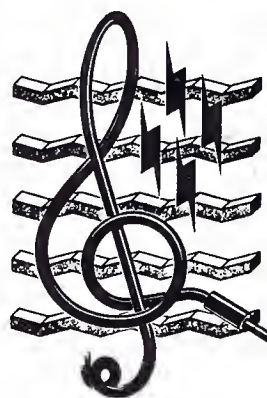
At this stage, it is perhaps wise to leave register 7 (the enable register), register 6

(the noise register) and registers 11, 12 and 13 (the envelope registers) alone and just experiment with the tones. You will notice that the higher the number loaded into the tone period register-pair, the lower the sound. Fortunately, the relationship between a note's frequency and the value needed in the register-pair can be calculated by a series of formulae in Basic, and a short program can generate a look-up table containing all the period value needed for an eight octave keyboard.

Listing two shows the program, which works for the Spectrum or the Amstrad depending on whether you type line 110 or line 120. Octave 0 is taken as the octave containing International A.

Formulae

Octaves beneath this are numbered -1, -2, -3 and -4, while those above are numbered 1, 2 and 3. In each octave the twelve notes C, C#, D, D#, E, F, F#, G, G#, A, A# and B are numbered 1 to 12. The key formulae are as follows:
FREQUENCY = 440*(2^(OCT+((N-10)/12)))
PERIOD = CK/FREQUENCY
 which the Basic program rearranges to ►





● Amstrad CPC664: one of the micros with the AY-3-8910/8912 chips

► produce a period value from the supplied octave number (OCT) and note number

(N). CK represents the frequency of clockticks fed to the PSG and the value is different between the two brands of computer – which is why the period tables in the back of the CPC manuals are not suitable for the Spectrum. To achieve middle C, 209 is placed into register 0 and to get International A register 0 is loaded with the value 124. These are high notes, so the coarse tune register stays empty.

The results have been checked on a Casio keyboard, so the formulae should work.

Subroutine

Before looking at the remaining PSG registers, it's useful to know exactly what the machine code is doing. A short subroutine drives the PSG by using the value in the Z80's A register to address the correct PSG register, and then the value in the Z80's D register is used to load the selected PSG register. For the Spectrum, this subroutine is contained in DATA line 570 in the main "tester" listing. The source code is in figure one.

A PSG register-value can be read on port address FFFD (65533), and if you

decide to do this from Basic you might encounter a slight problem.

I have an early Spectrum 128 and it seems that the designers have done something which tends to stop IN/OUTs to the PSG working as they should. For example, the IN 65533 statement above should return 56 (the value the tester program had put there) but you might get something else, such as 255. The problem may be that the "short" part of the port address, FD, is being used by 128-Basic for paging and RS232 duties and that these house-keeping routines are interfering with the PSG registers and *vice versa*.

Somewhere in the 128ROM someone might have used an OUT (FD),A to perform a housekeeping task, instead of the more lengthy LD BC,7FFD:OUT (C),A. The former instruction can affect FFFD; the latter will not. Alternatively, there may be a pcb tracking error on my 128. However, since the machine-code routine used by the PSG test program lives in a little world of its own (even interrupts can't touch it), it behaves correctly.

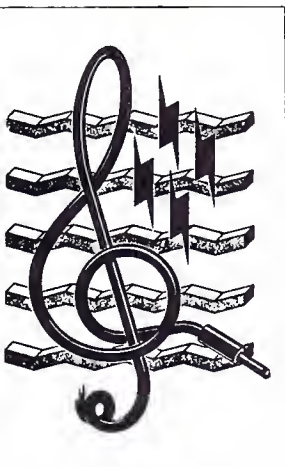
Dangerous

The possibility of a bug is relevant, though – I must report that after using the PSG testing program, the printer attached to the RS232 interface doesn't always work. This annoys me, since I made the machine-code longer than it really needed to be so that values dangerous to PSG

register 7 could be trapped. (Register 7 controls register 14 on which hangs the RS232 and other hardware bits). Be warned, I found that only a hard reset cures the non-responsive printer situation.

Natural

Register 7 is an 8-bank software switch, the natural state of which is 00111111. Bit 7 can be ignored – it has a function only in the AY-3-8910 chip. Bit 6 must always be zero, since that keeps PSG register 14 as an INPUT port. The other bits are all ones, which means they are all inactive – as switches they are OFF. Bits 0, 1 and 2 are switches for the three TONE channels, bits 3, 4 and 5 are switches which mix the single NOISE source into the three TONE channels. The PSG tester starts with a setting for TONES ON and NOISE OFF so register 7 is given 00111000, which is 56 decimal. Try to give it any combination of 11xxxxxx and the machine code will automatically reset bits 7 and 6 to zero. That x means either a 0 or a 1; it doesn't matter. The PSG tester will allow you to type in BIN 00111000, or any other BIN number, but you must type (extend) "B" and not the letters "B", "I" and "N". So, register 7 is used mainly as a mixer. Random noise superimposed on a tone can create a more natural sounding musical note but can also produce some noisy hisses as well. Experiment and see.





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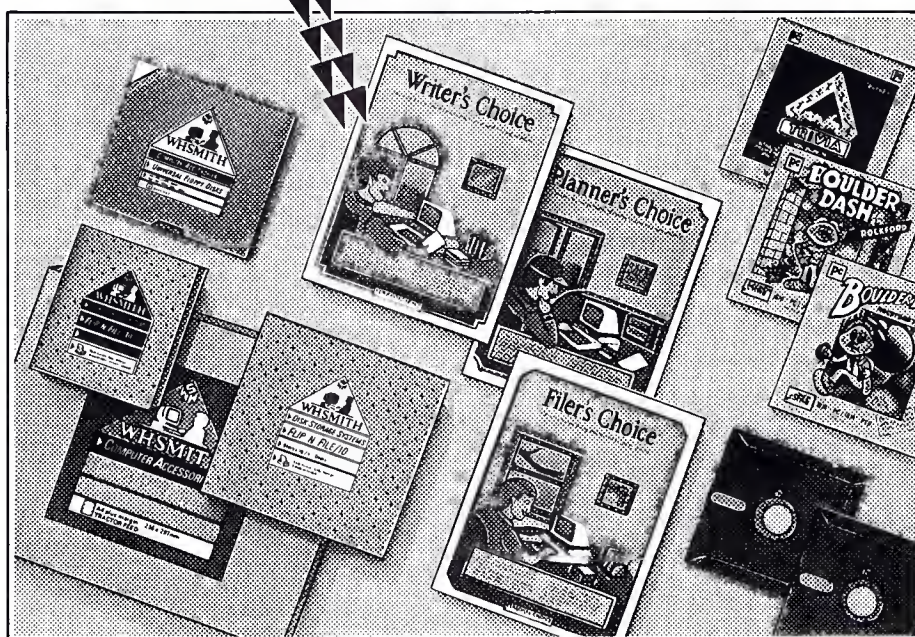
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ANALYSING *algorithms*

Some people enjoy analysing algorithms, and the ability to predict the future. It gives them a sense of satisfaction, in much the same way as when a newly written program works for the first time. There is a much more important reason for such analysis, however. Time means money, and the longer and less efficient the algorithm, the more costly would be its use.

An algorithm is any precise method of solving a specific problem. In this article we will be considering algorithms only where each step can be easily defined, and where the algorithm will eventually terminate. This type of algorithm is often known as a *computational procedure*. In effect, we are saying that any algorithm we consider will work the same way on any conventional computer, and could be worked out manually using pencil and paper, though this may take rather longer than on a computer.

Even computer algorithms of this type can take an inordinate amount of time to terminate. For instance, we could easily devise an algorithm which plays chess.

Positions

Given any starting position, it would consider possible moves by White, followed by all of Black's replies, then the White moves from these positions, and so on. Eventually, this simple routine will reach the end of the game, and thus be

Marcus Jeffrey shows the uses which algorithms can serve in micros

Thus we are particularly concerned with the efficiency of any particular algorithm. As the data increases, will the algorithm time increase exponentially? If so, then it is probably not very efficient for large amounts of data, and a different approach should be used.

Another factor which should be examined is storage. Some algorithmic solutions may be able to solve problems in a very short time, but require extremely large amounts of storage in which to do so.

Storage

Obviously in all these cases, we could simply program the algorithm, then test it to see how much time and storage it uses for all the various possible sets of data. However, a much better method is to be able to analyse the best, average and worst case behaviour of an algorithm before it is written.

One of the simplest ways of determining the efficiency of an algorithm is to perform a frequency count. Here we ignore the rudimentary operations being performed, such as addition and multiplica-

puting time will generally increase. We have to be careful here, because it is possible to produce an algorithm with a lower order of magnitude which is quicker than one with a higher order of magnitude, for a certain type of problem. This is a rarity, however, and will only come about if the operational speed for the higher order algorithm is significantly quicker. Even then, the lower the order, the more efficient the algorithm.

So if we assume that each operation takes a constant time of one unit, then we can calculate the times taken by the algorithms or orders n , n^2 and n^3 . For $n=100$, these times will be 100, 10,000 and 1,000,000 time units respectively.

It is often the case that a particular algorithm has two different orders of magnitude. For instance, a table look-up algorithm may have a table ordering process and a separate look up process, and each of these sections may have a different order of magnitude. In such cases the higher order is always used, because as the data increases (as the value of n is increased), the higher order algorithm will predominate.

Relationships

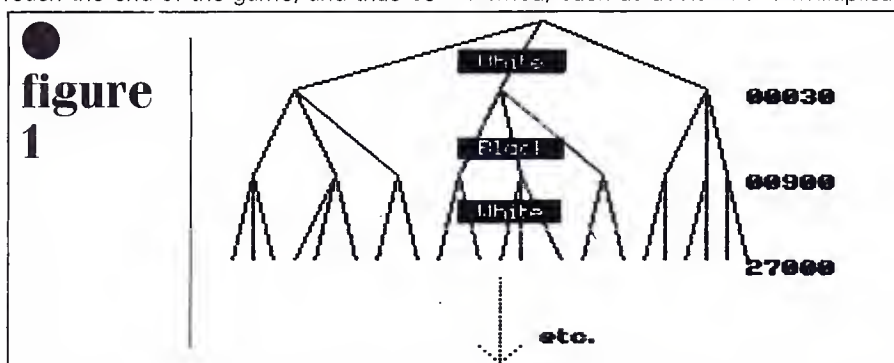
The way in which this works, and the relationships between a number of common orders, is shown by the graph in figure 3. This shows how the computing time of algorithms increases as their orders of magnitude increase. It is fairly clear that you would usually choose a $\log_2 n$ algorithm over an n algorithm, and so on. The order of an algorithm is traditionally shown in the form:

$O(\log_2 n)$ for $\log_2 n$.

Thus we can rate the algorithms in order of preference, as shown in figure 4.

This has been heavy going so far, so let's look at a practical example. Let us assume that you've just started a new club, which at present has only 20 members, but you expect this to grow rapidly in the near future. Being the club's computer expert, it is up to you to keep records of all the members on a database, and be able to print these out in any order. You duly set up all the database files, and eventually sit down to write the sort routine which will allow you to print out the records in any desired order.

Now, let us assume that any basic operation takes exactly one second to



able to decide which is the most appropriate move from the original position. However, the tree which would be built for this approach would expand exponentially (figure 1), with an average of 30 possible moves from the original position, 900 replies to these, 27,000 White replies to these moves, then 810,000 and so on. This sort of computation would take billions of years to work out, even with the fastest computers.

tion, and simply look at the number of times statements are encountered. If we take the three program examples shown in figure 2, we can assign a simple frequency count as:

- (a) 1
- (b) n
- (c) n^2

These are known as the *orders of magnitude* of the algorithms. As the order of magnitude increases, so the overall com-

(a) LET x = x + 1

(b) FOR i = 1 TO n
LET x = x + 1
NEXT i

(c) FOR i = 1 TO n
FOR j = 1 TO n
LET x = x + 1
NEXT j
NEXT i

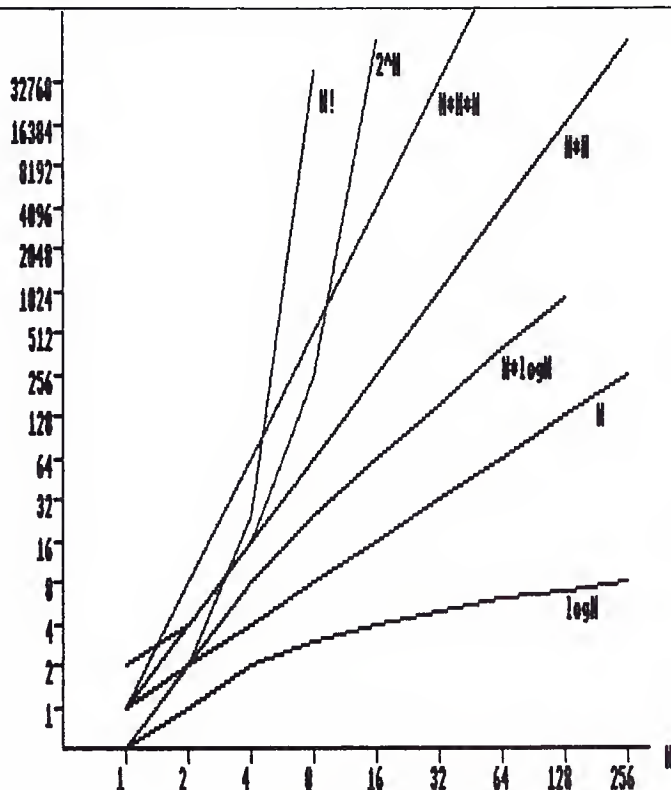
figure 2

This particular sorting algorithm is of the order $O(n^2)$, so we can assume that it takes 20^2 , or 400 seconds to complete its sort. This figure can be improved slightly by noting that the algorithm doesn't go through the already sorted values at the end of the list on subsequent passes. In addition, if we put in a variable to count the number of values swapped during each pass, then we could stop as soon as zero items were changed. This would give us a best case of n operations (i.e. one pass of the list). Despite all these short-cuts, the order of the algorithm, which is an upper bound on its performance, remains unchanged, and would

from, all of which work better than the cumbersome bubble sort.

Having said this, no sorting algorithm which needs to compare complete values against each other can ever do better than $O(n \log_2 n)$. One such sort algorithm is known as mergesort. This works by splitting a list into two roughly equal parts, then sorting each of these, and finally recombining the two parts to form a completed list. Of course, when it comes to sorting each of the two smaller lists, mergesort uses its own algorithm to split these into two still smaller lists, and so on. This is shown by the code in figure 7, which uses recursion, so that you will see

figure 3



perform. This is not entirely realistic, but will suffice for our purposes. If you could find a method of sorting all the records using just one statement, then no matter how many members you had, it would always take one second to sort them into order. This would be an order $O(1)$ algorithm. By the way, you are not allowed to cheat by claiming that your GOSUB to the sorting procedure counts as a single statement.

Scanning

The most straightforward approach to the problem is probably the bubble sort, shown in figure 5. This routine works by scanning through the entire n items (in this case club members) and adjacent items, so that the highest value reaches the end of the list (assuming we want to sort them into ascending order). It then goes through the remaining $n-1$ items for the next highest number, and so on. This ripple effect continues until the entire list is sorted. This operation is shown in more detail with the list of numbers 1 to 8 in figure 6.

figure 5

BUBBLE SORT ROUTINE

```
Procedure BUBBLESORT(low,high)
;M(low..high) is a global array containing
; values to be sorted.
integer low, high, i, j
;
for i = high-1 to low step -1
for j = low to i
if M(j) > M(j+1)
then SWAP(M(j),M(j+1))
endif
endfor
endfor
end BUBBLESORT
```

where SWAP exchanges the two values.

take almost three hours for 100 members, over 11 hours for 200 members, and so on.

When this sort of bottleneck occurs it normally means that you are using the wrong approach to the problem. In this case there are a bewildering variety of computer sorting techniques to choose

and start again from the top of the routine. Each time the routine calls itself, you should tear off the top sheet of the pad, label the next sheet with the previous LEVEL+1 and add one to the last NUMBER used at the new LEVEL.

Just to make things a little clearer, figure 8 shows how mergesort would

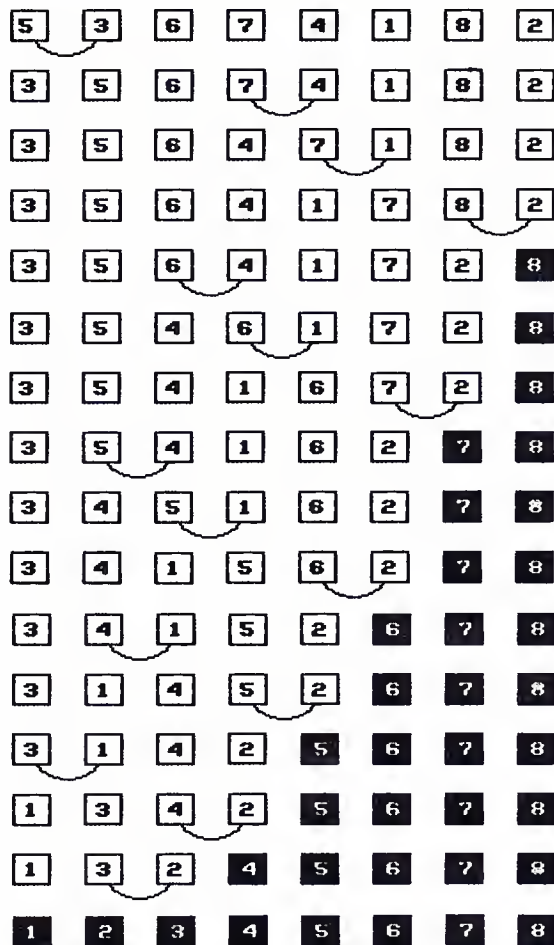
figure 4

ORDER OF PREFERENCE	
1 ...	$O(1)$
2 ...	$O(\log_2 n)$
3 ...	$O(n)$
4 ...	$O(n \log_2 n)$
5 ...	$O(n^2)$
6 ...	$O(n^3)$
7 ...	$O(2^n)$
8 ...	$O(n!)$

mergesort calling itself – a clever feat.

If you find the concept of recursion a little difficult to handle, try taking a pad of paper and numbering the top sheet LEVEL 1, NUMBER 1, meaning the level one and sheet one. Write down the list of items which you intend to sort (the array A) on this sheet, and start working through the routine. When you come to a point where the routine calls itself, simply tear off the top sheet, label another sheet as LEVEL 2, NUMBER 1, copy only the values which are passed as parameters,

figure
6



handle the list of numbers from figure 6.

The advantage of the mergesort algorithm is that its worst-case time is $O(n \log_2 n)$. However, you should note that its best time is also the same order, unlike

the bubble sort algorithm which stands a chance of getting it right first time. If we look at the time taken by the mergesort and compare it to that of the bubble sort, we find that sorting 20 members takes

100 seconds, sorting 100 members takes under 12 minutes and sorting 200 members takes less than half an hour.

Behaviour

As mentioned earlier, some problems take just too long to solve on a computer. We have already seen one example of this when we looked at the game of chess. In this case, the game itself is so complex that no better method of solving it has been found. Many methods have been tried, but the best way to play the game is still copying human behaviour, where the machine builds a tree of moves and looks ahead as far as possible to find out what the game will look like in the future. That is not to say that a simple algorithm for the game of chess does not exist. It may be that there is a function, $f(\text{chess})$, which given a chess position as a parameter will be able to determine which side has won, or whether the game is a draw. It may also be the case that it can give a win or lose answer to the starting position of the game, though many ardent chess fans hope that machines never become this sophisticated.

There are a wide variety of much simpler problems in computing, which exhibit the same worst case behaviour as the game of chess. In other words, the best solutions found so far still require that all possibilities are checked.

One famous example is that of the travelling salesman. Given the distances between, say, ten different cities, the salesman has to find the shortest route between them, ending back where he started. Since he's visiting all the cities, it doesn't really matter where he starts. However, he then has to choose between nine other cities, and from these there will be eight further choices, and so on. Each of these will give a different route; resulting in $9!$ (factorial, that is, $9 \times 8 \times 7 \times \dots \times 1$), or 362,880 different routes.

If we assume that we have a very fast computer that can check 100 routes per second, this will still take about an hour. What happens if we double the number to 20 different cities to visit? The same computer will now take 38,573,408 years to solve the problem! I am quite sure the salesman will have died of old age waiting for the computer to tell him where to go.

Insoluble

After years of research, nobody has been able to come up with a quicker solution to this and similar problems. In fact many people believe that these problems are computationally insoluble in a reasonable time, though nobody has yet been able to prove this.

You may feel that your average salesman is unlikely to want to use a computer program to plan his route, but will instead choose a route which looks reasonable. However, this same problem crops up in, for instance, routing problems for large

figure
7

MERGESORT ROUTINE

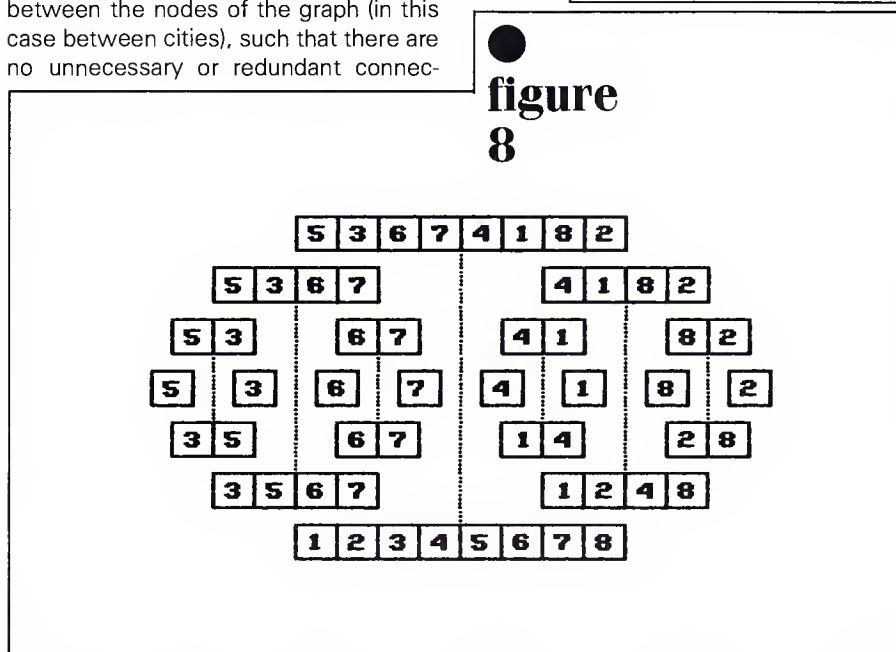
```

Procedure MERGESORT(low,high)
;M(low..high) is a global array containing
; the values to be sorted.
integer low, mid, high
;
if low < high
then mid = INT((low+high)/2)
MERGESORT(low,mid)
MERGESORT(mid+1,high)
MERGE(low,mid,high)
endif
end MERGESORT

Procedure MERGE(low,mid,high)
;M(low..high) is a global array containing two
; sorted subsets in:
; M(low..mid) and M(mid+1..high)
integer i, j, k, t, low, mid, high
array N(low..high)
;
i = low : j = low : k = mid+1
while i <= mid and k <= high do
if M(i) <= M(k)
then N(j) = M(i) : i = i+1
else N(j) = M(k) : k = k+1
endif
j = j+1
endwhile
if i > mid
then for t = k to high
j = j+1
endfor
else for t = i to mid
j = j+1
endfor
endif
for t = low to high
M(t) = N(t)
endfor
end MERGE
  
```


haulage contractors. In this instance, not only distances, but many other factors, such as roadworks and height/weight restrictions, also have to be taken into account.

Obviously using the greedy $O(n!)$ algorithm is not feasible. Instead, a number of near-optimal solutions have been devised. For instance, if the cities are shown in the form of a graph, a minimum spanning tree can be devised. A spanning tree is a set of connections between the nodes of the graph (in this case between cities), such that there are no unnecessary or redundant connections.



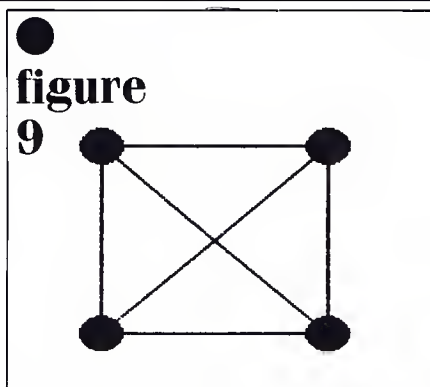
tions. In the four node graph in figure 9 (shown with all its possible connections), there are a number of different spanning trees, some of which are shown in figure 10. If we assign costs to these connections (known as edges), then the minimum spanning tree is a spanning tree which gives the minimum total value when all the edges are added together.

Circular

Now, given a set of cities (figure 11a), we can devise a minimum spanning tree (figure 11b). If we make this tree into a circular route (figure 11c), then it has been proved that in the worst possible case, this route will be no more than twice the optimal length. Figure 11d shows how this route can be simply reduced further by eliminating routes which visit a city a second time.

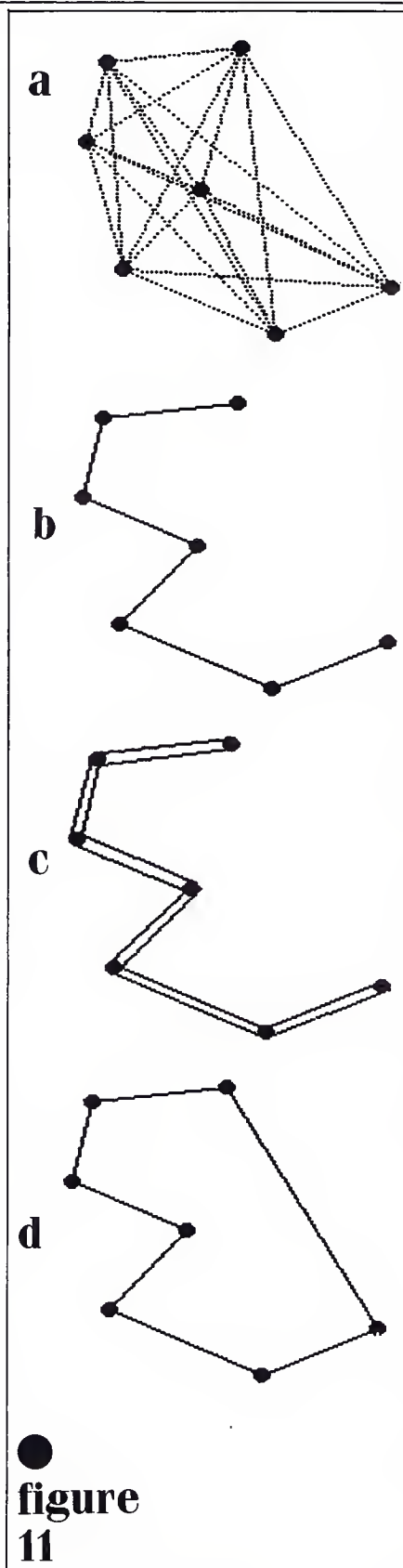
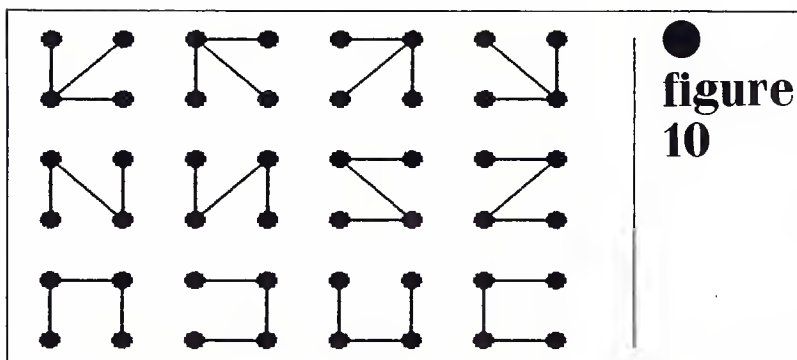
There are many problems of this type in computing. For instance, allocating available memory between multi-tasking jobs is an example of the bin-packing problem, which is again $O(n!)$. This, in effect, tries to fit rectangular sections into a larger rectangle. Imagine it as trying to cut sheets out of a large sheet of metal. Many sub-optimal solutions exist, most of which require that the jobs be sorted into a particular order before they are analysed.

Other problems of this type include fitting objects into a hypothetical knapsack



(typical uses in storage and packing), scheduling problems (used in computer and industrial situations), and graph isomorphism (matching two graphs – used in chemistry and mathematics).

I hope this brief and hectic look into the world of algorithms has served to show that though the computer revolution is changing the face of the world, there are still some problems that even computers can't solve. More importantly, I have tried to emphasise the importance of planning a program before writing it. In addition to the flow-charting and data structure design which people talk about, you should analyse the time factors involved in your solution. You may find that you are trying to solve an impossible problem. Even if this is not the case, you may find that you are implementing an $O(n^2)$ solution, when an $O(n \cdot \log_2 n)$ algorithm exists which will work more quickly.

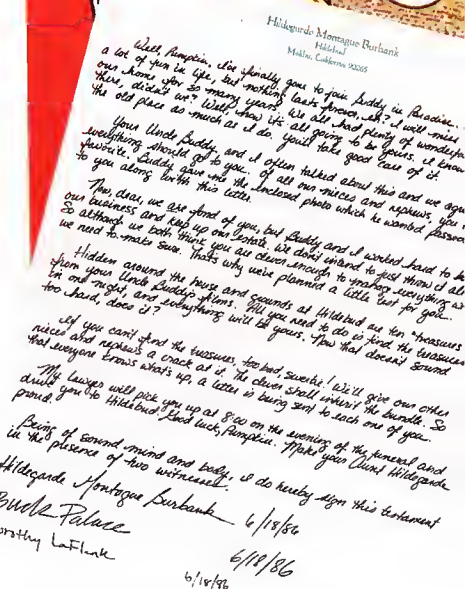


To most people, Hollywood means swimming pools, movie stars, Disneyland and Greyhound buses. But to Infocom, it's also a signal for giggles and intrigues – as Mike Gerrard discovers

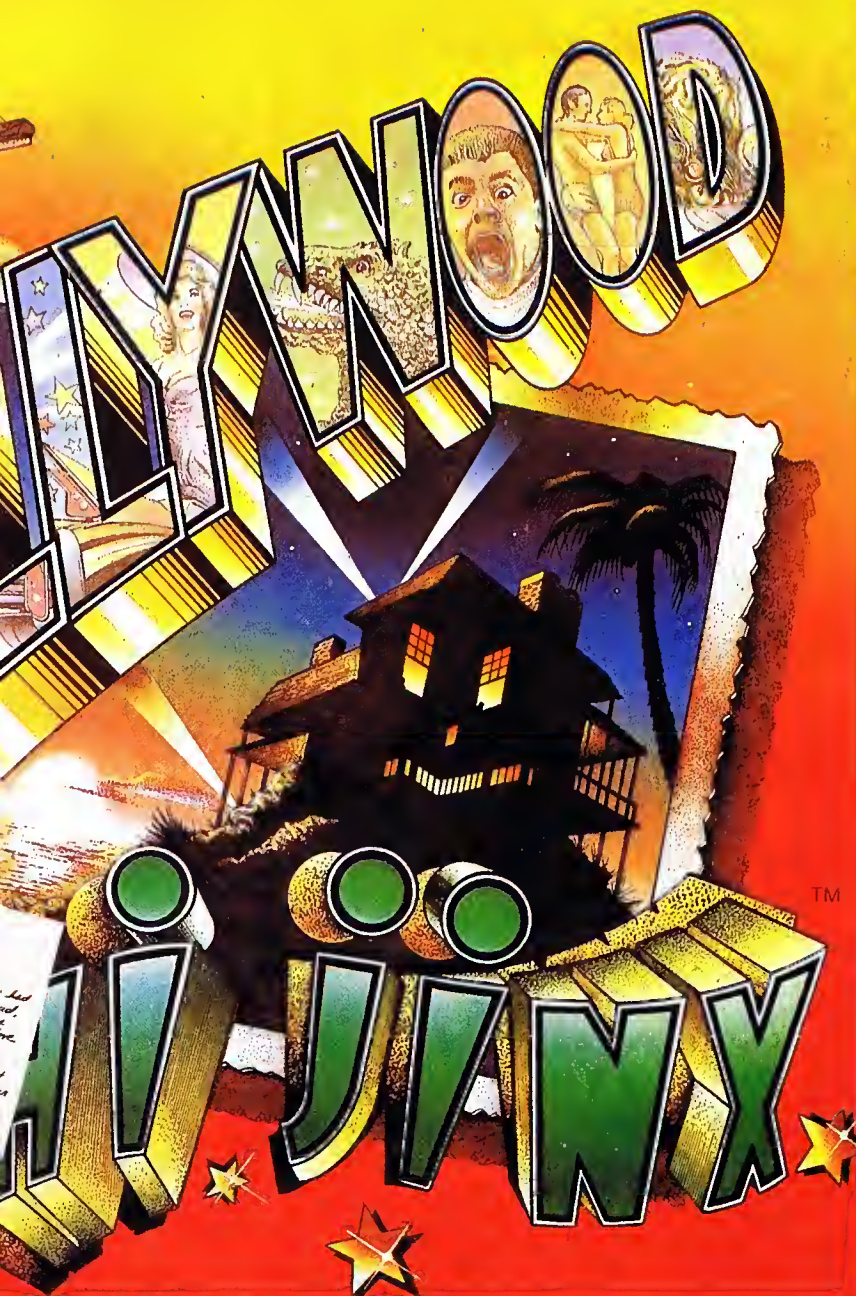
(B) £29.99

Well, I wasn't planning on doing much for the next few evenings anyway. So what goodies do we find inside the latest little gem of packaging? We have a lucky palm tree swizzle stick, a signed photo of Uncle Buddy Burbank (director of such Hollywood classics as *Vampire Penguins*), a letter from your late Aunt Hildegarde Montague Burbank and a copy of *Tinsel World*, one of those Hollywood showbiz scandal rags. This one includes such tasteful articles as "Crazed Gerbil Attacks Gramps" and "Dill Pickles Add Years to Your Life", alongside ads for baldness cures and Fat-Melt chewing gum ("uses a natural combustive process . . . completely safe . . . This advertisement is void where prohibited by law.")

You already have got a flashlight for when you get inside the house, where



Down in the cellar there is a functioning computer, if you can find the right punch cards, and this could lead you to hearing the message to end all Answerphone messages: "I can't come to the phone right now, because I'm dead." You must look inside, behind and under everything, although this doesn't always work. Looking under a Persian rug in the Living Room produces the message: "You move the



- **Left:** In his own write – what Hildegard Montague Burbank jotted down in such neat script. Will it be a clue?

rug but don't find any trapdoor." Rats!

In the Game Room there's one of the funniest Infocom problems since the Babel Fish first appeared, and that's the scale model of downtown Tokyo as seen in one of Uncle Buddy's epics, *Atomic Chihuahuas from Hell*. The problem is less complex than the Babel Fish, in fact it is fairly straightforward, but making the scale model work through pressing the different coloured buttons on the side had me in fits of laughter – and eventually had the blue diamond treasure in my hands. Not all treasures are quite so traditional, however. I mean, Uncle Buddy's toupee and a cheese grater? Still, each is worth ten points towards the 150 you're chasing.

This is definitely one of the funniest Infocom games, and is written by a new writer, Dave Anderson, formerly an

- **Right:** downtowner Buddy Burbank – he filmed classics as well as popcorn



- **Above:** Tootsie Goldman – what's her role?
- **Right:** A Corpse Line still unseen



- **Right:** Tinsel World – priceless gems to make even Rupert Murdoch blush



- **Left:** shown actual size – a lucky palm tree swizzle stick; normally \$12.95... but free with Infocom's Hollywood Hijinx

adventure tester for the company. It has to be said that it is one of the easier titles, too. Not that I've finished it yet, but it only takes a few hours of play to get well into the game and track down six or seven of those wretched treasures. Having said that, a few more hours of play have left me well and truly stuck unless I can tilt the floor of the room with the piano in it, get back up from the beach after getting down there over the gap in the ladder or figure out a way of getting a source of light underwater. And what are those strange noises coming from outside the maze and all around the house?

I *will* get there, though, as I can't let that horrible cousin Herman have the last laugh and pocket the goodies. Not after what he did over my Aunt's favourite rose bush when we were children. And over me from the top bunk of the bed. Nasty!

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QUESTIONS

1. How many keys are there on a standard Atari 520 STE keyboard?
2. How many bytes of RAM are there in an Atari 520 STE, expressed in binary?
3. Which other large computer manufacturer was Jack Tramiel once responsible for?

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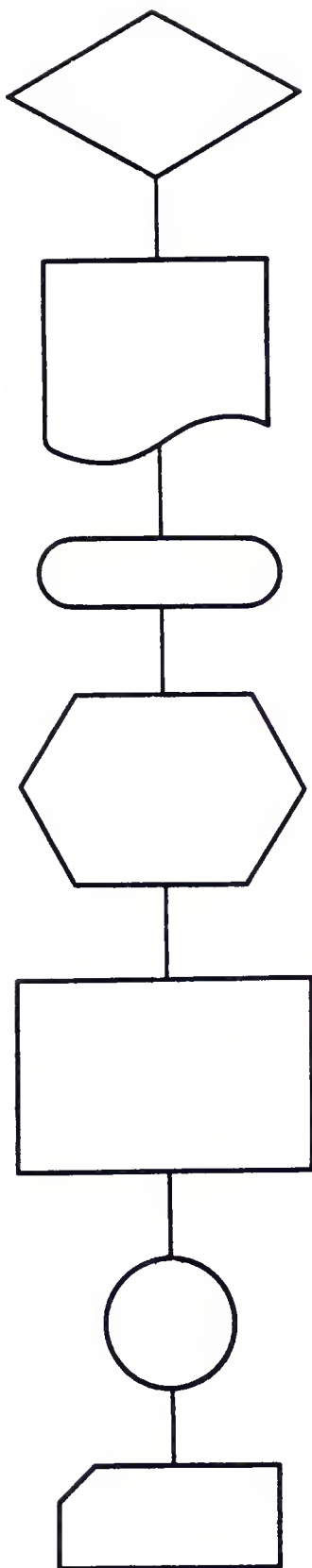
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ADVENTURE BUILDING



Pete Gerrard takes a further peep at a blueprint for an elaborate adventure game you can tap in for most micros

It must not be assumed that writing a complete adventure program is going to be an easy task. It won't be. On the other hand it is not quite the daunting proposition that a lot of people seem to think it will be. All that code, the many possibilities to think about, whether graphics or text, tape or disk, where do you start?

Suppose you wanted to build up a finished, marketable adventure game. You won't be reaching the giddy heights of Infocom or Level 9 games, but you will be close. Close enough so that, with a little ingenuity, even a seasoned campaigner will find it difficult to tell the difference.

In common with Infocom, the adventure-writing style that we'll be demonstrating here will not consider graphics. Firstly, because I do not like graphical adventure games. In theory of course that is neither here nor there, but if you didn't like cooking I wouldn't expect you to cook, for instance, a curry for me. You would go to the nearest Indian takeaway.

Transportable

If you want graphical adventures, buy them. However, there is another, more serious, reason to avoid graphics.

The techniques explained here were developed on a 65xx series machine, but in order to make them as transportable as possible we've stuck to Basic as our programming language. This doesn't really matter, as most computers now have very powerful compilers available for them, so if you want you can always compile your own finished product for that extra little bit of speed. More importantly, computers tend to be in a world of their own when producing high resolution graphics, and anything said about the topic on one computer would not apply to any other. Consequently, graphics are given the elbow.

That explains what we are going to do, and how we are going to do it. But why are

we going to do it? Why not use The Quill, or the Graphics Adventure Creator, or any other similar aid?

I am not denying the powerful abilities of the aforementioned aids to creating adventure games. However, they do share a fault, which is that adventure games created using those systems do tend to have a similar look about them. A Quilled game is a Quilled game, whichever way you look at it, and most of them are easy to spot. By doing the programming yourself, you can add those touches of individuality that distinguish the great from the merely good. You might argue that this is just giving you another system, but no.

To go back to our cooking analogy, we're giving you the ingredients not the recipe. How you put it together is up to you. Hopefully you'll end up with something a little bit more appealing than burnt toast.

Parser

Possibly the most important part of any adventure game is the link between you and the computer. In other words, that part of the program that takes your command, interprets it, hopefully understands it, and then passes that information to another part of the program so that it can act on it. This we refer to as a parser, and there are many different types.

Early adventure games restricted themselves to what is known as a VERB . . . NOUN style of command entry. If you wanted to, for example, pick a key up, insert it in a lock, unlock the door and enter, you might have to type in something like this:

**TAKE KEY
UNLOCK DOOR
ENTER**

The adventure program should then sort everything out. More recent and sophisticated programs allow you to type in something a little bit more advanced, such as:

**PICK UP KEY THEN INSERT IT IN LOCK,
UNLOCK DOOR THEN ENTER**

This is somewhat galling if you type the first word incorrectly and don't notice it until you've entered the rest of the command, but it does allow you to speak to the program in a more conventional, almost conversational style. Of course, this sort of sophistication leads to some mighty puzzling problems, and the old complaints about the VERB . . . NOUN school of entry

figure 1

```

9000 P1$=CM$
9002 CM$=""
9004 REMinder
9006 A$=GET$
9007 H=LEN(CM$)
9008 IFA$="" THEN 9006
9009 Z=ASC(A$)
9010 IF (Z<65ORZ>90) ANDZ<>32ANDZ<>44ANDZ
<>13ANDZ<>20 THEN 9006
9011 ZL=LEN(CM$):IFZL>75 AND (Z<>13 AND
Z<>20) THEN 9004
9012 IFZ=32 THEN CM$=CM$+" ":PRINT " ";GO
TO 9004
9013 IFZ=44 AND ZL=0 THEN 9006
9014 IFZ=13 AND ZL<>0 THEN PRINT " ";CHR$(
127);".":PRINT:PK$=CM$:RETURN
9015 IFZ=13 THEN 9006
9016 IFZ=20 AND ZL<>0 THEN PRINT A$;:CM$=L
EFT$(CM$,ZL-1):GOTO 9004
9017 IFZ=20 THEN 9006
9018 CM$=CM$+A$:PRINT A$;:GOTO 9004

```

figure 2

```

4000 REMinder of something
4001 PR$=CM$:PN$=NO$:PP$=N1$:SE=0:AG=0:
IF AN THEN CM$=AN$:GOTO 4005
4004 PRINT">";:GOSUB 9000
4005 IF LEFT$(CM$,5)="AGAIN" THEN AG=1:
CM$=PR$:AN$=MID$(AN$,7):PK$=MID$(PK$,7):
IF AN$="" THEN AN=0
4006 IF LEFT$(CM$,1)="A" THEN AG=1:CM$=P
R$:AN$=MID$(AN$,3):PK$=MID$(PK$,3):IF AN
$="" THEN AN=0
4007 IF LEFT$(CM$,3)="WHY" THEN PRINT"B
ecause I say so.":SE=1:GOTO 4999
4008 IF LEFT$(CM$,4)="WHER" OR LEFT$(CM
$,4)="WHAT" THEN PRINT"Find out yourself."
:SE=1:RETURN
4010 NO$="":LI$="":AC$="":VB$="":NO=0:V
B=0
4011 N1$="":L1$="":A1$="":V1$="":NO=0:V
B=0:AC=0:LI=0:IF LEFT$(CM$,3)="DO" THEN 4
500
4012 LC=LEN(CM$):IF LEFT$(CM$,3)="SAY" TH
EN VB=35:RETURN
4013 GOTO 4300
4014 FORI=1TOLC:IF MID$(CM$,I,1)=" " THE
N V1$=LEFT$(CM$,I-1):K=I:GOTO 4016
4015 NEXTI:V1$=CM$:GOTO 4040
4016 FORI=KTOLC:IF MID$(CM$,I,3)=" A " T
HEN CM$=LEFT$(CM$,I-1)+MID$(CM$,I+2)
4017 NEXT:FORI=KTOLC:Z$=MID$(CM$,I,5)
4018 IF Z$=" " THE "ORZ$=" " HTE " THEN CM$=L
EFT$(CM$,I-1)+MID$(CM$,I+4):IFZ$=" " HTE "
THEN 4700
4019 NEXT
4020 FORI=K+1TOLC:IF MID$(CM$,I,1)=" " T
HEN L1$=MID$(CM$,K+1,I-K-1):K=I:GOTO 4022
4021 NEXT:N1$=MID$(CM$,K+1):GOTO 4040
4022 FORI=K+1TOLC:IF MID$(CM$,I,1)=" " T
HEN A1$=MID$(CM$,K+1,I-K-1):K=I:GOTO 4024
4023 NEXT:N1$=MID$(CM$,K+1):GOTO 4040
4024 FORI=K+1TOLC:IF MID$(CM$,I,1)=" " T
HEN N1$=MID$(CM$,K+1,I-K-1):K=I:GOTO 4040
4025 NEXT:N1$=MID$(CM$,K+1)
4040 NO$=LEFT$(N1$,4):AC$=LEFT$(A1$,4):
LI$=LEFT$(L1$,4):VB$=LEFT$(V1$,4)
4050 REMinder
4051 FORI=1TINV:IFVB$(I)=VB$ THEN VB=1:GO
TO 4054
4052 NEXTI:VB=0:DN$=V1$:GOTO 4080
4054 IFLI$="" THEN 4064
4056 FORI=1TONL:IFLI$(I)=LI$ THEN LI=I:GO
TO 4064
4058 NEXTI:LI=0:DN$=L1$:GOTO 4080
4064 IFAC$="" THEN 4074
4066 FORI=1TONA:IFAC$(I)=AC$ THEN AC=I:GO
TO 4074
4068 NEXTI:AC=0:DN$=A1$:GOTO 4080
4074 IFNO$="" THEN NO=0:RETURN
4075 IFNO$="IT" THEN NO$=PN$:N1$=PP$
4076 FORI=1TONN:IFNO$(I)=NO$ THEN NO=I:GO
TO 4084
4078 NEXTI:NO=0:DN$=N1$:GOTO 4080
4080 SE=1:IFVB$="*****" OR VB$="*****" THEN P
RINT"Watch it.":RETURN
4081 GOTO 4086
4082 IFDN$="A" OR DN$="AGAIN" THEN PRINT
"You're trying to confuse me!":DN=1:SE=
1:RETURN
4083 PRINT DW$;X$;DN$;X$;".":DN=1
4084 RETURN
4086 V$=LEFT$(DN$,4):FORI=1TO50:IFV$=VB
$(I) OR V$=NO$(I) OR V$=AC$(I) OR V$=LI$(I) THE
N 4088
4087 NEXTI:GOTO 4082
4088 PRINT DW$;X$;DN$;X$:PRINT"in that c
ontext.":RETURN
4300 IFAG=1 THEN 4400
4301 AN=0:AN$="":FORI=1TOLC
4302 IFMID$(PK$,I,1)=" " THEN AN$=MID$(PK
$,I+1):CM$=LEFT$(CM$,I-1):PK$=MID$(PK$,I
+1):AN=1:GOTO 4400
4304 NEXT
4305 IF AN$="A" OR AN$="AGAIN" THEN AN$
=CM$
4400 LC=LEN(CM$):SE=0:FORI=1TOLC
4402 IFMID$(CM$,I,7)="*****" THEN CM$=L
EFT$(CM$,I-1)+MID$(CM$,I+8):GOTO 4407
4403 IF CM$="*****" OR CM$="*****"
THEN PRINT"And you.":SE=1:RETURN
4404 T$=MID$(CM$,I,8):IFT$="*****" OR
T$="*****" THEN PRINT"Behave.":GOTO 4999
4405 IFMID$(CM$,I,4)="****" THEN PRINT"Cu
rb your tongue.":GOTO 4999
4406 NEXT:GOTO 4600
4407 PRINT"Stop swearing.":GOTO 4999
4499 RETURN
4500 PRINT "Erm, no.":SE=1:RETURN
4600 REMinder of something
4601 GOTO 4014
4700 PRINT "I assume 'hte' is meant to
be 'the'." :PRINT:GOTO 4019
4999 SE=1:RETURN

```


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ADVENTURE BUILDING

still apply. More often than not you will waste a reasonable amount of time racking your brains trying to think of precisely the right word to type in. TAKE might work, GET might not, for instance. However, there are ways around this, as we shall see in a later article.

Once you have a list of words (they're not necessary yet, don't worry) you'll want to go about building up a routine to sift through anything the user might type in and translate it into a series of numbers on which the program can then operate.

Before we can begin the translation we need to receive the words, and so the short input routine in figure 1 does the job for us.

Picky BBC owners and others can replace RETURNS and REMs with ENDPROCs and DEFPROCs respectively, if they want.

To run through it briefly, line 9002 declares our comment string CMS\$ to be a null one, and clears out the keyboard buffer of any unwanted characters that might be floating around. Line 9004 prints a space onto the screen, then waits to accept the next letter from the user. Instead of a space you could use any other symbol that takes your fancy: a plus sign, for example, as in *The Hobbit*. Some computers might not accept these symbols, so adjust to fit your machine.

Lines 9006 and 9008 await the pressing of a key. Normally of course this would only take up one line, but in the adventure from which this routine was taken, line 9007 was used to check on the amount of time the user took to make his entry. That is not needed here, however. Line 9009 then converts the keypress into an ASCII value, and line 9010 takes that value and checks to see if it falls within a given range. Characters with ASCII values of 65 to 90 are the letters of the alphabet, unshifted; the character with ASCII value 32 is a space, 44 is a comma, 13 is the carriage return, and 20 on the machine used is the delete key. Thus, if the key pressed does not correspond to one of those, then it's back for another one.

Maximum

Line 9011 checks for the length of the string. A maximum of 75 characters are allowed for, and if the user is trying to enter something beyond that without using the delete key or the carriage return key, then ignore it and go back for more. Lines 9012 and 9018 simply take the key pressed and add it to our input string, while line 9013 checks to make sure that a comma is not the first key entered. Lines 9014 and 9015 see if the carriage return has been pressed, and checks that the input string

does actually contain something, while lines 9016 and 9017 do the same for the delete key. Program flow resumes when at least one character, and not more than 75 characters, are entered and the carriage return key has been pressed.

All very well, we now have our entry from the user of the program stored in the string CMS\$. Now on to how to interpret that string. First, a few straightforward ground rules.

Linking

In order to be able to make sense of the input string, the program must also contain a list of words that it can understand and act on. The verbs and nouns mentioned earlier will be part of this list. However, many other words will be needed as well. I term these 'linking' words such as 'by', 'on', 'under', and so on, and possible 'action' words which may be the same as link words, but may equally be different. For example, take the following sentence:

PUT THE KEY UNDER THE MAT

Ignoring the two THEs, which the parser will sort out for us later, this sentence can be broken down into the following components:

VERB: PUT

LINK: KEY

ACTION: UNDER

NOUN: MAT

By skilful use of link and action words, a wide variety of commands from the user can be catered for with an array consisting of verbs, another one for link words, a third for action words, and a final one for nouns. As it stands, this routine will only look at the first four letters of a word, so that COVER would be the same as COVEN, for instance. That can easily be changed, as we shall see.

Another rule concerns the joining together of sentences. Do we use the word AND, or THEN, or simply a comma? In this program, I have opted for a comma, so that the command line "OPEN DOOR, CLOSE IT, GO NORTH, N, E, UP, LIE ON THE MAT, GO TO SLEEP" would be translated as eight separate commands, all of which would be acted out in due course. You could use AND or THEN if you wished, but a comma takes less checking time.

There are more things to consider. Do we allow for swear words? Regrettably the answer to that one is yes, but being a family magazine they have been omitted from the listing. Is the use of the word 'IT' allowed, as in "OPEN DOOR, CLOSE IT" given earlier? Yes, is again the answer; it takes up very little extra code. Finally, do we check the spelling of the entry? If the user types in "WTCH THE GATE" do we

translate that as "WATCH THE GATE" or not? The answer to that is yes, it would be a good idea; no, I'm not going to do it this month.

Before venturing into figure 2, a few words for Spectrum owners and users of different computers. You will note from the listing that extensive use is made of LEFT\$ and MID\$ in order to analyse selected parts of strings. All well and good, but of course the Spectrum doesn't have those commands, and uses its own 'slicing' command to achieve the same aims. Thus, any occurrence of something like "IF LEFT\$(CMS\$,1)" must be replaced by "IF CMS\$(1 TO 1)" and something like "MID\$(CMS\$,1,5)" must be replaced by "CMS\$(1 TO 1+5)".

Finally, Spectrum owners, there is another variant on the MID\$ command that must be taken care of, and it is illustrated in this statement: "MID\$(CMS\$,5)", which means take the string CMS\$, start at the 5th character, and then include every character from the 5th one to the end. Spectrum slicing has no equivalent for this, and so one must find out the length of the string first. This is done by the following chunk of code:

LC=LEN(CMS):AS=CMS(5 TO LC)

This whole routine, from line 4000 on to line 4999, is one massive subroutine, so again BBC owners can replace RETURNS with ENDPROCs, and might care to add a few ELSEs of their own, since some dialects of Basic lack this rather important feature.

Incrementing

There is a lot of jumping out of FOR...NEXT loops, and some computers might not like this. If yours is one of them, replace the loop with a simple incrementing variable, so that:

200 FOR I=1 TO J:IF MID\$(CMS\$,I,5)="THE "THEN 400

210 NEXT
becomes

200 I=I+1:IF MID\$(CMS\$,I,5)="THE "THEN 400

210 IF I<>J THEN 200

which should solve that particular problem.

We can break the listing down into a number of smaller modules: first of all lines 4000 to 4013. Apart from declaring a lot of variables to be zero or null and going off to our earlier input routine, two important things are done here. Line 4003 checks the variable AN, which is set only if a comma is found in the input string CMS\$. If it is set, then we know that there is another command still to be obeyed (such as UNLOCK IT if original input string was ►

ADVENTURE BUILDING

KICK DOOR, UNLOCK IT), and so there is no need to go to the input subroutine. Line 4005 checks to see if the input string contains the word AGAIN, as in "KICK DOOR AGAIN" for a particularly stubborn door. If AGAIN is found, then set the variable AG.

Lines 4014 to 4019, first of all, check to see if a space has been entered by the user in order to separate words. If it hasn't, then only one word was entered, which must be a verb in order to make any sense (you don't just type in the word DOOR, for instance, although sometimes verbs are inferred, as in INVENTORY becomes TAKE INVENTORY: your list of words must allow for this). Line 4016 takes the redundant character 'A' out of a sentence (as in FIND A KEY), while line 4018 does the same for the word 'THE' (as in FIND THE KEY). This reduces the list of understandable words needed, and in the examples given the input string is reduced down to FIND KEY. Line 4018 performs the additional task of correcting a single spelling mistake by leaping off to line 4700 if necessary.

Selective

Lines 4020 to 4050, having found our verb earlier on, search through the input string for spaces, and, depending on the number of spaces found, break the string down into our list of verb, link word, action word and noun. This is a selective search so that if, for instance, only two words are entered then the first one is the verb and the second one is the noun. If three are entered, then the second one becomes a link word and the third one becomes a noun. Finally if four (or more) are entered, the third becomes an action word and the fourth one becomes a noun.

Lines 4051 to 4088 search selectively through our list of known words, taking them in the order verb, link, action, noun, with NV representing the number of verbs, NL the number of link words, and so on. As you can surmise from the listing, the known words are stored in arrays VBS, LIS, etcetera. Note in particular line 4040, where everything is chopped up into a four letter word. This can be altered if you want to search for more than the first four letters of each word (Infocom usually uses six), by using NOS=LEFTS(NIS,6) (for example), and so on.

If a match is found, set the appropriate variable and trundle resolutely on; if no word has to be checked then ignore that section of code and leap to the next one, but if a match isn't found, then set the string DNS to be equal to the unknown word. Line 4080 checks for a rude word (insert your own!), while line 4082 prints out the unknown word and tells you about

figure 3

```

1 X$=CHR$(34):CP=1:FL=0:CM$="LOOK"
2 DIM SD$(64),P$(64,6)
3 DIM DD$(6)
4 DW$="I don't know the word "
5 NO$="":N1$="":AN$="":AN=0:DN=0
6 FOR I=1TO6:READ DD$(I):NEXT
7 DATA NORTH,SOUTH,EAST,WEST,UP,DOWN
8 GOSUB1000
9 GOSUB4000:IFSE=1THEN72
10 IFVB=0THENPRINTDW$:X$:CM$:X$:GOTO1
11 02
12 75 IFDN=1 THEN DN=0:GOTO102
13 77 GOTO 108
14 102 PRINT ">";:GOSUB 9000
15 104 IFLEFT$(CM$,12)="NEITHER DO I"THEN
16 PRINT"Good.":GOTO6094
17 106 GOSUB4007:IFSE=1THEN75
18 108 PRINT"VB$="VB$:PRINT"LI$="LI$:PRIN
19 T"AC$="AC$:PRINT"NO$="NO$:PRINT"CM$="CM$
20 :GOTO72

```

it. Incidentally, the routine from 4086 to 4088 is checking to see if the word is a known one but is being used in the wrong context. That is, a noun as a verb, or an action word as a link word, and so on. If that is the case, rather than a totally unknown word, line 4088 prints up a rather more helpful message.

Note in particular line 4075. If the sentence entered by the player was something like "UNLOCK DOOR, OPEN IT" then IT is replaced by the word DOOR in that particular line.

With lines 4300 to 4304, the input string is checked for commas and adjusted accordingly. Thus if "UNLOCK DOOR, OPEN IT" was entered, then this routine would keep the first part (UNLOCK DOOR) in CMS and the second part (OPEN IT) in AN\$, as well as setting the variable AN. Thus back at the start line 4003 takes care of this eventuality.

Prayer

Regrettably most of lines 4400 to 4999 are taken up with checking for swear words, so insert your own if you want, or just utter a pious prayer and assume that no one will swear at your finished program. Fat chance. Incidentally, line 4402 does give the user a second chance, if a particular seven letter word is entered. The sentence is stripped of that word and assumes its more innocent meaning, so that if the user were to type in "AGAIN" after being told off for swearing, the sentence would in fact be allowed and acted on accordingly.

In order to make it look as if the program is more intelligent than it really is, con-

sider using the contents of figure 3, or try this alternative line:

```

4006 IF LEFTS(CMS,3)="WHY"
    THEN PRINT"BECAUSE I SAY
    SO.":RETURN

```

Ignore the various calls to subroutines at the moment, but concentrate instead on lines 73 and 102 to 106. Can you work out what they are doing? I know that makes it all sound a bit like Play School, but try to work it out for yourself anyway.

Curious

Finally, let us consider the curious line 200. This is added to make a little bit more sense of long inputs like "TAKE KEY, UNLOCK DOOR, OPEN DOOR, ENTER, CLOSE DOOR, TURN LIGHT ON" etcetera. Instead of responding with OKAY, or something, every time an action is performed, line 200 prints out YOU TAKE THE KEY (or whatever), which at least lets you know what's going on. But be careful. YOU TURN THE ON doesn't make a lot of sense, so do not use this routine lavishly.

Your homework is to devise a routine to check the spelling of entries, and the little hint given earlier should set you off in the right direction. If you want to be really sophisticated, think of arrays and matching elements.

I don't expect you to follow the routines given here straight away, but give it a bit of thought and all should become clear eventually. You'll probably have to make some minor modifications for your own computer anyway.

Next month we will continue with a look at text compression and screen layouts, both of which help to give extra polish.

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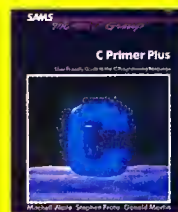
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- *The graphics library contains arty, provocative, images which you can use at any size*



HARRIER



Mirrorsoft has finally broken through the price barrier and made desktop publishing an affordable proposition for everyone owning an Atari 520ST or 1040ST. At just £115, Fleet Street Publisher is about the cheapest desktop publishing package currently available.

The Apple Macintosh with Pagemaker has been the preferred combination for desktop publishing for some time now. This is all very well for companies that can afford to shell out several thousands of pounds on hardware and software but what about the individual who just wants to be able to produce the odd newsletter or club magazine?

It is just such a person who will benefit most from Fleet Street Publisher, investing in desktop publishing software that

The typeset copy, or *galley*, is then sent to a page layout artist who designs the page. Having finally received the artwork from the artist, you send it to a printer to be duplicated.

This process is expensive in time and money. Furthermore, the number of people involved in getting your work to the printers increases the likelihood of errors appearing in the finished document.

A desktop publishing program can ease such problems, since it enables you to write, typeset, lay out and print your own documents without outside help.

The Fleet Street Publisher package consists of three disks and a generally informative manual, nicely presented in a small ring binder. One of the disks con-

beneficial, since it allows you to see at a glance when you last worked on particular files. This is especially useful if you have files that need to be updated at regular intervals.

After you have logged on, the screen clears to reveal a blank window and a line of eight icons, running down the left-hand side of the display. For reasons which I will explain in a moment, the window is a text window and, because it is the first one to be shown after the program has loaded, is marked with the default filename SHEET1.TXT.

Five of the eight icons relate to Fleet Street Publisher's operating modes, which are Picture Block, Picture Edit, Box Rule, Text Block and Text Edit. The other three represent text overflow, a clipboard and the familiar trash can.

A bar along the top of the screen contains the main menu headings: Desk, File, Options, Typography and Layout. Under these are stored long lists of utilities for use when making up a page. Some of the utilities are mode-specific, though most are available throughout each stage of the production process.

Traditional

When you load Fleet Street Publisher, it boots up straight into Text Edit mode, hence the blank text window mentioned earlier.

As in the traditional page make-up process, the first stage is always to write the copy. This can either be done using Fleet Street Publisher's simple, though effective, text editor, or by importing ASCII files prepared on a word processor.

Few people would want to write all their copy using Fleet Street Publisher's text editor, but for small portions it is ideal. Apart from several basic delete functions, the text editor also contains facilities to allow you to extract a whole area of text and either delete it, copy it, move it, or put it in the clipboard for later use.

Care is needed when using this last facility, as the clipboard can only hold one block of text at a time. If you attempt to store an extract in the clipboard while the icon is black, the signal that it is full, it will simply overwrite your previously stored work.

After the copy is written, the first stage in the actual make-up process is to design a page format. Selecting New Page from the Options menu produces a dialogue box titled page layout. In this are contained boxes which allow you to set the page width, the size of the spaces at the top and bottom of the page, the right and left margin sizes, and the number of columns.

Stored in this menu are the present values for A4, B5, US letter, US legal and tabloid page sizes. Or you can, if you wish, define your own page using an

Stephen Applebaum gives a direct-input software package from Mirrorsoft a good run for its money. He looks at it from the eyes of a beginner bewildered by the concepts of typefaces and layouts

costs a fraction of the price of Pagemaker; putting Mirrorsoft's package right up there with its more expensive counterpart, challenging its superiority.

Typesetter

Fleet Street Publisher is designed to take all the hard work out of designing and printing professional-looking documents. If you want to produce, say, a newsletter, and are to go about it in the traditional way, you first produce the copy, then give it to an outside typesetter. He returns it to you later to be checked for errors that may have occurred during the typesetting process.

tains the actual program and the other two are used to store fonts and a graphics library.

The number of fonts included in the package is disappointingly low at six. A list at the back of the manual attempts to gloss over this deficiency by showing twelve fonts, but it does not take the deductive powers of Sherlock Holmes to see that the six extra ones are no more than bold versions of the same typefaces.

Conversely, the graphics library is a bumper pack of illustrations as diverse as vignettes of male and female yuppie types to small motifs of vehicles, signs of the zodiac, religious paraphernalia, animals and so on.

Conversion

Although the selection of graphics in the library is good, serious users will probably find it too limited. So, for those people who would like to design their own pictures, Mirrorsoft has included an art conversion program that allows graphics to be imported from dedicated art packages such as Art Director, Degas and Neochrome.

The first thing you encounter when loading Fleet Street Publisher is a log-on dialogue box. This takes advantage of a facility in Gem which saves the date and time you logged on alongside your files.

Logging on is not mandatory, but is

- *Segments of Europe and a Harrier are among various elements of the graphics library which will make any layout shine*



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This be the demented Hartnell. This rare photograph clearly shows his 16K brain reeling from the absurd generosity of this offer.

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option called 'Other' by the directory.

If you choose to use one of the preset pages, the only variable you have to insert is the number of columns you want your page to be divided into. Having received your figure, the computer calculates the width of the columns.

Guidelines

When the layout box disappears, it reveals the top part of your page with the columns' outlines described on it in dots. These columns are not permanent fixtures, but are merely rough guidelines to help you in the next phase of production.

Only part of a page can be displayed on the screen at normal magnification. This is because what you are seeing is an exact, full scale representation of what will finally be output to a printer. It would be impossible, to show a complete A4 page, as the screen is simply not big enough. The advantage is that you can see exactly what will be printed before wasting any paper.

Advantageous as a WYSIWYG display is, the page has to be scaled down during the layout stage. This is done by altering the magnification via a function in the Options menu. Pages can be magnified

Once all the columns have been assigned text blocks, the next stage is to drop text into it using 'Merge Text' from the Files menu. What quite often happens when text is merged is that there is too much for the whole file to be dropped into one column and so you get an overflow. When this happens, the Text Overflow icon turns black to indicate that there was too much text for the first text block to contain.

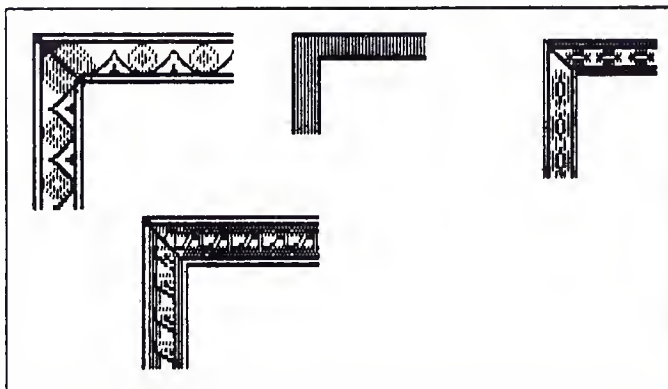
Depressing the mouse button when the cursor is on the Text Overflow icon picks up the remaining text, turning the cursor into a white arrow with the letters 'abc' on it.

Moving this into the next column deposits the text onto the page.

If you do not like the way the text looks, you can make changes to it by selecting a wordily titled function called 'Face, Size, Leading' from the Typography menu.

Using this function, you can do almost anything you like to the text. It is possible to change the font, the line spacing, the point size, italicise certain words, write words in bold and even change the width of a character in relation to its height. Because of the Atari's WYSIWYG display, all these changes can be seen happening

- **Borders and bubbles and word blurbs are among the exciting features of Fleet Street Publisher**



from 12.5 per cent to 200 per cent of actual size. For layout purposes, however, a selection called Fit Window is used. This reproduces a reduced version of the page in a window to the left of the work area. A page reduced in this way can be worked on in exactly the same way as if it were full size.

Dotted

Before any text can be entered onto the page, the dotted columns must first be turned into text blocks in the Text Block mode. A text block is opened by positioning the mouse cursor at the top left-hand corner of a column on the reduced page, holding down the mouse button and dragging the cursor to the bottom right-hand corner of the column. This action produces a box that will accept text being merged into it.

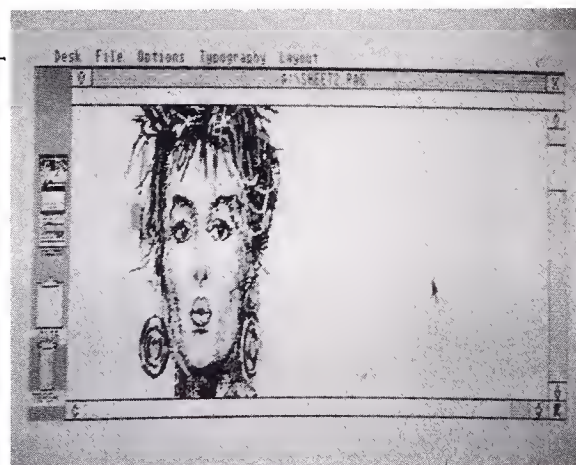
Text blocks are created for each of the columns unless they are all to be the same size as the first one. In this case all you need do is copy the first text block onto their guidelines.

on screen, as you make them; there is no need to have to wait for the printed version to discover what the finished document looks like. Other facilities in the Typography menu allow you to change the maximum spacing between characters, so that you can get the page to look exactly as you want it to.

Before a picture can be 'pasted' onto a page, you must first make a picture block in Picture Block mode. Picture blocks are made in exactly the same way as text blocks. Unfortunately, though, you do not know how big to make the block as the size of the picture is more or less defined from the time it is drawn. If, when a picture is loaded, it is either too large or too small for the picture block, you can change the size of the block to accommodate it more easily.

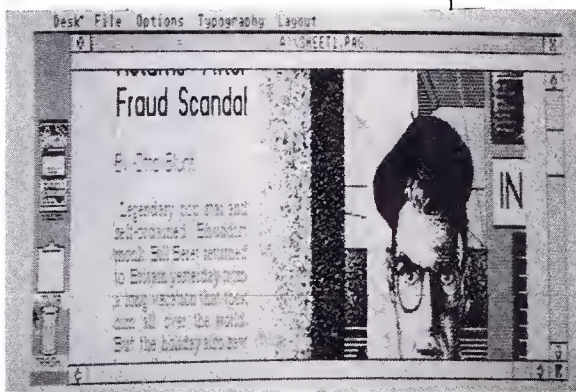
Upsetting

Altering the picture block's dimensions is not always advisable, since it can mean upsetting the layout of the text.



Where this is the case, it is better to rescale the actual picture to make it fit the original space allocated to it.

In trying to rescale a picture, I uncovered one of several errors in the Fleet Street Publisher manual. The section on rescaling states, quite incorrectly, that you must hold down the shift key on the Atari keyboard while manipulating the picture's borders with the mouse. If anyone reading this has used Fleet Street Publisher and has tried unsuccessfully to rescale a picture, this is because the key



that you should be pressing is in fact 'CONTROL'!

A convenient feature of Fleet Street Publisher is the use of key macros. These allow you to store up to 20 pieces of text or frequently used typographical styles on the function keys F1 to F10 and the Alternate key. This means that you can access a stored function with a single keystroke.

Pages designed with Fleet Street Publisher can, as well as being saved onto disk, be output to an Epson compatible printer, or any type capable of producing a 480 dot bit image. No provisions for a laser printer have been included in the program, but Mirrorsoft plans to release a laser printer driver in the near future.

Overall, Fleet Street Publisher is an excellent product, bringing desktop publishing well within the reach of most people. The only part I find annoying about this product is the manual, which, for all its good looks, contains several errors. Apart from that, Fleet Street Publisher is a triumph of singular quality, and a program well worth investing in if you are in the least interested in desktop publishing.

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**The Z88 portable is Sir
Clive Sinclair's most
recent innovation. Is it
a real breakthrough or
another lost
opportunity? Geof
Wheelwright examines
the evidence**

LIKEABLE LAP-TOP

Sir Clive Sinclair has done it again. His latest offering, the Z88 – this time offered under the brand name Cambridge Computer as the rights to use the Sinclair name were sold to Amstrad – continues a long tradition of producing innovative low-cost Z80 based machines.

At £200 this ultra-light battery-operated portable computer breaks new ground in a number of areas – although not all of them are something that Sir Clive should be particularly proud of.

The first and creditable pioneering feature is the price. The Z88 is undoubtedly the first portable of this specification to be priced significantly under the £400 price mark. You may be able to pick up older Tandy Model 100 or NEC PC8201 portables at this price (incidentally, they are a good buy if you do), but there are no new machines in this league that approach Sir Clive Sinclair's low price.

Another matter entirely, however, is what you get for the price. The simple feature list includes a weight of less than two pounds, dimensions that make the entire package no larger than a thick A4 magazine, a built-in eighty character by eight line supertwist LCD display, built-in word-processing, database, time and data management software, a claimed 20 hour battery life, 32K RAM minimum (expandable up to 4MB internally), a Z80 version of BBC Basic, an RS232 port for printing and data transfer and a document layout screen that shows you in a dynamically updated fashion just how your final document will look.

A number of these features are quite problematic. The first innovation is the display, which is of the older 8 line by 80 column type. While this is augmented by an well-designed windowing system that

allows you to see document commands, page preview and machine status along with the main screen, these nice touches do not overcome the flaws of the display.

It is flawed for several reasons – not the least of which is the availability of full-screen (ie. 80 columns by 25 lines) LCD displays of the supertwist and backlit types. These may have required a little more power and cost a little more to buy, but would have been far more attractive than the smaller screen Sir Clive selected.

No descenders

The display is made worse by the character set which is composed entirely of letters with no descenders. The bottom half of a letter such as 'g', 'p' or 'y' is scrunched into the same space as a non-descended character such as 'f'.

To give Sir Clive his due, however, the screen was by no means unreadable on the pre-pre-production machine I saw at the Which Computer Show launch in February, and will probably prove adequate for most portable data-entry tasks if people can get the hang of the dynamic page layout facility – which I again unreservedly applaud. I felt he could have bought a better display which showed a good deal more, but I can understand how that might have proved a threat to both battery life and the low price of the machine.

The second rather odd innovation is in the way memory is handled in the unexpanded machine. The machine, as advertised, is due to come with 32K – of which only a maximum of 15K is available. For a machine which is supposed to be a portable notebook among other things, this is not a great deal of room.

Sir Clive points out that this limitation



Cambridge Computer Ltd designed this RAM or EPROM cartridge for the Z88 portable personal computer

could be overcome by adding a 32K or 128K RAM cartridge (which come as either standard CMOS RAM for £19.95 and £49.95, respectively, or as an EPROM for £12.95 and £49.95). Those who choose the EPROM route for memory expansion and wish to erase information they put onto them will also have to purchase a £49.95 ultra-violet EPROM eraser. I suspect, however, that these memory add-ons may not be available at the same time as the machine itself, so you probably will have to limp

patible manufacturer. It would have been nice, and not too expensive, if he had been able to add a parallel printer port as well.

Printing is not the only way you can get information out of the Z88. To allow users to move text and other data, generated by the Z88, back and forth between it and a PC, Cambridge Computer is offering a 'transfer pack'. This is a cable which runs between a PC and the Z88, some IBM-compatible communications software, and instructions on how to use it with the

ing to bother with a modem will leave you with no other method of storage. Unlike other portables of this size, the Z88 has no facility for storing data on cassette tape or disk drive. The only way you can hang onto your data is to buy Sir Clive's EPROM cartridges and save essential data there.

Future expansion

The company is providing a Z80 expansion bus for future expansion, for which an enterprising third-party manufacturer would certainly be well-advised to consider a disk drive of some description. A disk drive using this interface that reads and writes data in IBM PC format, would be a way of adding a great deal more to the value of the system.

As it stands, the Z88 is a somewhat limited portable with some impressive-looking applications and an ambitious design. Whether it's really worth the £200 asking price will come to light in a month or two when users all over the country start trying to communicate with a host of printers, modems and PCs. If the Z88 can pass that test, then it may well live up to its publicity. However, that will be difficult as Sir Clive and his Cambridge Computer company have set themselves a tall order. By promising, and taking orders for all kinds of add-ons, communications systems and even a modem, Sir Clive seems to have set himself up for a fall.

At press time in April, the company has not shipped a single Z88, let alone any add-ons for it. If it has not begun shipping the machines in volume by the time you read this, Cambridge Computer and the Z88 could fall victim to the so-called 'QL syndrome', in which cheques are taken from customers up to six months before goods are delivered.

That would be a real shame as the Z88 definitely looks promising and if supported properly could be a great success. Sir Clive must make sure that it doesn't suffer the kind of delivery shortfalls that occurred in the latter days of Sinclair Research. We can only wish him the best of luck.



The new Z88 personal portable which was unveiled at the 1987 Which Computer Show in February

along with the basic 15K memory for at least a little while. If my scepticism is proved inappropriate you will be able to add up to 384K RAM to the system right away (the Z88 offers room for the addition of up to three memory cartridges).

Promising software

Things are not all cloudy on the Sinclair horizon, however, as the internal software actually looks quite good. The word-processing software, for example, includes multiple column layout, integration of spreadsheet information within the word-processor, search and replace functions and on-screen page breaks. As everything happens in RAM, you can easily switch between word-processing, spreadsheet and diary functions without having to execute any 'save' functions first. Commands within the various Z88 applications seem to be fairly consistent so that anyone who takes the time to use the word-processor will subsequently have fewer problems getting to grips with the database, spreadsheet, diary functions and so on.

Printing takes place via the RS232 port, not an unusual state of affairs given the recent standardisation of serial port printing by companies like Apple but not, as Sir Clive indicated, by IBM or any major com-

puter manufacturer. Although not completed at the time of launch, this crucial ingredient to integration in any kind of PC-based office is claimed to be a method of moving data back and forth between the two machines in data formats that include those used by Wordstar, Lotus 1-2-3 and Word Perfect.

If you have no IBM-compatible machine at hand, Sinclair is proposing an alternative way to get information out of the Z88. This is via a planned modem, which Cambridge Computer has said will conform to the Prestel 1200/75 communications standard. Unfortunately, this is possibly the worst choice for communications speed as the Z88 screen does not really lend itself to a proper display of Prestel graphics.

Text transfer

A portable machine largely concerned with the transfer of text would be much better suited to using 300 or 1200 baud modems that could make better use of electronic mail, on services such as Telecom Gold and One to One. If, however, the RS232 port is reasonably buffered then independent software and hardware companies may start to produce a better communications system that's a little more sensible. This issue though, is one about which I can't begin to make a judgement on until the company starts shipping production machines.

Not having another PC around or want-

Z88 specification

Price: £199.95 exc VAT. Dimensions: 11½" x 8¼" x 7¼" (293 x 209 x 23mm). Weight: 1 lb 14 ozs. CPU: Z80 (CMOS). ROM: 128K bytes (1 megabit) containing operating system and applications software together with Basic/Assembler. RAM: 32K expandable via 32K bytes, 128K bytes and 1 Mbyte cartridges to a maximum 3 Mbytes battery-backed from the computer. EPROM: Up to 3 Mbytes removable storage capacity via 32K bytes, 128K bytes and 1 Mbyte cartridges. Display: 8 x 80 character 'supertwist' LCD - dark blue on grey - with four windows: menu options, work area, machine status and new screen map. Power: 4 AA batteries; mains adaptor option. Ports: Three for cartridge expansion, RS232 for most popular printers. Z80 Expansion Bus: providing future expansion options.

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C - CASSETTE	✓	✓	✓	✓	✓	✓	✓
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DRAW CIRCLE	✓	✓	✓	✓	✓	✓	✓
DRAW LINE	✓	✓	✓	✓	✓	✓	✓
DRAW TRIANGLE	✓	✓	✓	✓	✓	✓	✓
DRAW RAYS	✓	✓	✓	✓	✓	✓	✓
PEN THICKNESSES	1	5	5	1	1	4	1
PEN QUILLS	—	3	3	—	—	2	—
PAINT BRUSH	—	✓	✓	—	—	✓	—
TEXT	✓	✓	✓	✓	✓	✓	✓
PIN POINT ACCURACY	✓	✓	✓	✓	✓	✓	✓
ACTIVE BANDING	✓	✓	✓	✓	✓	✓	✓
COPY FUNCTION	✓	✓	✓	✓	✓	✓	✓
WASH	✓	✓	✓	✓	✓	✓	✓
COLOURS	27	16	121	121	16	8	4
FILL	✓	✓	✓	✓	✓	✓	✓
FILL PATTERNS	5	11+5	11+5	5	—	7+5	5
ERASE FUNCTIONS	✓	✓	✓	✓	✓	✓	✓
SAVE SCREEN	✓	✓	✓	✓	✓	✓	✓
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c) News	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) New technology reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Communications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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d) Practical Computing	<input type="checkbox"/>
e) What Micro	<input type="checkbox"/>
f) Which Computer?	<input type="checkbox"/>
g) Computer & Video Games	<input type="checkbox"/>
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7. What kind of computer do you use?

a) Apple Macintosh	<input type="checkbox"/>
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d) Amstrad PCW/PC	<input type="checkbox"/>
e) Commodore Amiga	<input type="checkbox"/>
f) Spectrum	<input type="checkbox"/>
g) Other (Please specify)	<input type="checkbox"/>

8. Which of the following peripherals do you use or intend to buy in the next 12 months?

	USE	INTEND TO BUY
a) Dot Matrix printer	<input type="checkbox"/>	<input type="checkbox"/>
b) Daisywheel Printer	<input type="checkbox"/>	<input type="checkbox"/>
c) Modem	<input type="checkbox"/>	<input type="checkbox"/>
d) Disk Drive	<input type="checkbox"/>	<input type="checkbox"/>
e) Ram Expansion	<input type="checkbox"/>	<input type="checkbox"/>
f) Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>

9. Which of the following applications packages do you own/intend to purchase during the next 12 months?

	USE	INTEND TO BUY
a) Word Processing	<input type="checkbox"/>	<input type="checkbox"/>
b) Database	<input type="checkbox"/>	<input type="checkbox"/>
c) Spreadsheet	<input type="checkbox"/>	<input type="checkbox"/>
d) Accounts	<input type="checkbox"/>	<input type="checkbox"/>
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f) Graphics	<input type="checkbox"/>	<input type="checkbox"/>
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h) Science/Engineering	<input type="checkbox"/>	<input type="checkbox"/>
i) Games	<input type="checkbox"/>	<input type="checkbox"/>
j) Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>

10. How much money have you spent on hardware/software in the last 12 months?

£0 – £50	<input type="checkbox"/>	£50 – £100	<input type="checkbox"/>	£100 – £200	<input type="checkbox"/>
£200 – £500	<input type="checkbox"/>	£500 – £1000	<input type="checkbox"/>	£1000 +	<input type="checkbox"/>

11. How much money do you intend to spend in the next 12 months?

£0 – £50	<input type="checkbox"/>	£50 – £100	<input type="checkbox"/>	£100 – £200	<input type="checkbox"/>
£200 – £500	<input type="checkbox"/>	£500 – £1000	<input type="checkbox"/>	£1000 +	<input type="checkbox"/>

12. When choosing computer products which of the following would influence you?

a) Advertisement in a magazine	<input type="checkbox"/>
b) Magazine review	<input type="checkbox"/>
c) Personal Recommendation	<input type="checkbox"/>
d) Price	<input type="checkbox"/>
e) Shop Display	<input type="checkbox"/>
f) Reputation of the Company	<input type="checkbox"/>

13. Do you find the advertisements in Your Computer

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b) Useful	<input type="checkbox"/>
c) Not useful	<input type="checkbox"/>

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C

Pt II

**We kick off this month
with three CP/M
benchmarks and
then flip through
four IBM-compatible
C compilers, all
courtesy of reviewer
Adam Denning**

Following last month's examination of the major C compilers for CP/M-based systems, we now look at the major compilers for MS-DOS and PC-DOS computers. The most prominent of the many on offer

Test	Secs HiSoft C V1.35	Bytes
1	1.3	4736
2	15.5	4736
3	17.0	4736
4	15.5	4736
5	17.1	4736
6	17.8	4736
7	***	****
8	***	****
9	99.1	4864
10	24.5	4736
11	6.0	4736
12	24.8	4736
13	6.7	4864
14	6.7	4864
15	***	****
Avg	21.00	

are Microsoft C, Lattice C, Zorland C and Aztec C.

The benchmark timings used throughout this article are adaptations of the PCW Pascal benchmarks. Where relevant, the benchmark programs have been changed in such a way that they take advantage of C language features rather than specific compiler advantages. For example, register variables are used for integer loop counter variables throughout. As far as the MS-DOS compilers are concerned, this means that only Aztec C and Microsoft C take advantage – the other compilers reviewed do not support register variables and therefore treat each register declaration as a normal auto (local) variable declaration, space being allocated for the

Test	Secs Eco C V3.45	Bytes
1	0.7	3968
2	8.4	3968
3	7.7	3968
4	7.5	3968
5	10.3	3968
6	11.7	3968
7	15.8	4352
8	17.2	4352
9	17.7	4096
10	17.2	3968
11	2.5	3968
12	17.1	3968
13	3.4	3968
14	3.5	3968
15	356.6	6656
Avg	33.15	

variable from the stack. As the 8086 family of microprocessors is relatively efficient at stack frame addressing, auto variables offer only slightly lower performance than register variables.

If we were to alter the register declarations to be auto, the benchmarks would be unfair. We can see no reason to write C programs primarily to circumvent shortfalls in implementation, so we stick by our choice of register variable declarations.

The benchmarks for MS-DOS compilers were run on a Zenith Z-150 PC-compatible, with a 20Mb hard disc drive and running MS-DOS 3.10. The figures show the execution speed in seconds and the executable code size in bytes. Tests 7, 8 and 15 involve floating-point arithmetic, which was done using double-precision numbers.

Test	Secs Aztec C V1.06d	Bytes
1	0.5	6016
2	6.3	6016
3	6.4	6016
4	5.5	6016
5	7.7	6144
6	7.6	6144
7	14.0	8192
8	15.6	8192
9	11.6	6144
10	13.2	6144
11	5.7	6144
12	11.8	6144
13	6.6	6144
14	6.6	6144
15	52.6	9856
Avg	11.45	

Manx Aztec C

Manx Aztec C is a compiler system with a good pedigree. Manx has produced compilers for most microprocessors for many years. Like the CP/M version which we looked at last month, the 8086 Aztec C system is available in three guises: the Commercial package, the Developer package and the Prime package. There was once a Personal variant, a subset of the Developer system, but I am led to believe that this has been dropped. A few suppliers seem still to stock it in this country, though.

The Commercial package is the big daddy of the range as it incorporates all the facilities of the other packages with some additions of its own. The compiler is provided in two forms, optimising and non-optimising. The optimising compiler is a full Kernighan and Ritchie implementation, complete with register variables (two per function), bit fields, structures, unions, floats and doubles, enumerated types and various other Unix System V and ANSI additions. It is not quite as up-to-date on these matters as Microsoft C, though.

The non-optimising compiler is faster but does not support bit fields or the newer System V/ANSI facilities. It is intended for quick compilations for pre-production testing. As the full optimising compiler is nearly as fast not many people are likely to be tempted by this feature.

The output of the compiler is 8086 assembler source in a form which is just sufficiently different from the Microsoft

Pt II

MASM-compatible form to be irritating. MASM is undisputed as the standard assembler for PC-DOS machines. That Aztec C's output is not entirely MASM-compatible is not terribly important as the compiler package includes a macro assembler. This is very useful for writing

Test	Secs	Bytes
	Aztec C V3.20e	
1	0.05	2554
2	1.1	2566
3	1.2	2566
4	0.9	2564
5	1.8	2574
6	1.7	2572
7	5.0	4614
8	5.3	4610
9	3.2	2588
10	2.9	2584
11	1.3	2610
12	2.7	2584
13	1.8	2630
14	1.8	2630
15	9.7	6204

Avg 2.70

functions in assembler for added speed and can even be used for program development. Once assembled, a source file needs to be linked with any other program modules and with the system library. Manx supplies a linker to do this. Manx has always adopted a unique linker format for its compilers and the 8086 version is no exception. The object code accepted by this linker is not even slightly similar to the Intel/Microsoft format used by most of the rest of the world. This is not really important, though, unless you're linking with modules compiled with other compilers. Manx solves this potential problem by supplying a utility to convert its object format into the Microsoft format. There isn't one to go the other way, though, which is a pity as the Manx linker is faster than Microsoft's.

Following compilation, you will almost certainly need to debug your code. Manx provides two debuggers for this purpose. One is called DB and it acts just like a conventional symbolic debugger operating at machine-level, with register displays and single-step facilities. The other debugger, SDB, is a vast improvement as it allows you to join in the current vogue for source level debugging. This facility gives you all the features of a more mundane debugger but also incorporates the ability to examine your C source code and step a line (or a function) at a time. Although there are better source level debuggers available, SDB is a very welcome and useful utility.

Other utilities available include a librarian for Manx-format object files, programs to extract and display information from object files and a useful if rather obscure object file squeezer. Our tests show that this utility can reduce the size of

a compiled program by up to 5%. It seems to optimise branches to the shortest forms possible, but it must do more than this to achieve the reductions in code size of which it is capable.

Also supplied with Aztec C is a useful package of Unix-style utilities including grep, diff, make and vi. Diff is probably bettered by the standard DOS utility FC, but grep and make always prove useful to the professional programmer. The usefulness of vi depends on whether or not you already have a text editor. Vi is seen by many as little better than EDLIN, but others swear by it. This implementation seems to be extremely close to the Unix original.

The library supplied with Aztec C includes all the standard Unix System 3 and Kernighan and Ritchie functions and also has a fairly extensive PC-specific library. Facilities for colour text, graphics and BIOS i/o are provided, making the



requirement to write special assembler functions for fast screen i/o redundant. The source for these functions is provided so it is easy to find out how everything is done if you don't already know.

Aztec C supports standard IEEE floating-point formats, using four bytes for floats and eight bytes for doubles. This means that the numbers are compatible with those used on the 8087 maths coprocessor. Aztec C is supplied with an 8087-only maths library as well as a sensing library (which uses the 8087 if one is present, but otherwise acts normally) and a standard maths library which does not require or use an 8087 chip.

The benchmarks show Aztec C to produce some of the fast, compact code and as the linker is capable of creating .EXE and .COM files, giving the option of more compact code if you decide a .COM file is better. The linker also manages to generate CP/M-86 .CMD files, which if you have the Commercial package means you can develop programs for CP/M-86 including

Concurrent CP/M and DOS Plus as well.

Aztec C is provided with a large amount of documentation supplied in a slip case and binder – there is only just enough room to hold all the pages. Everything you could ever need to know about the compiler, its utilities and the library functions is in the manual, although the organisation means that it can sometimes be hard to find. Not much mention is made of the syntax of C, so most programmers need a copy of Kernighan and Ritchie to hand as they use the package.

The Commercial package includes additional utilities and a special library for generating code destined for EPROM and it is in fact the only package reviewed here which provides enough facilities to make this process feasible.

The Developer version of Aztec C is a slightly cut-down Commercial package and comes without the library sources, without support for ROMmable code, without DOS 1.0 and CP/M-86 support and without some of the utilities. As it is considerably cheaper it may be a more useful package for the general programmer. Another package in the series is called C' Prime. This is actually Aztec Apprentice C (a small interpretive system for people learning C) and the non-optimising compiler from the other packages. Although C' Prime is fairly cheap, it is unlikely to be as useful to the novice or occasional programmer as Zorland C.

Microsoft C

Until fairly recently the compiler marketed by Microsoft was really Lattice C. When Microsoft decided to write its own compiler it started from scratch and produced a very powerful system which has been well received. This is known as Microsoft C V3.00. Since then, a number of improvements have been made resulting in V4.00. The whole package comes across as a professional programmer's package. The system incorporates the compiler, the linker (the most up-to-date version of the DOS linker, including overlay support), the librarian, a couple of .EXE file utilities and a reasonable version of the Unix make utility.

The most impressive part of the package for the first-time user, though, is the source level debugger called CodeView. This is a greatly enhanced version of Microsoft's SYMDEB debugger. It has windows showing the code, the user input, the registers and various watch and break points. Programs may be debugged as C source, as assembler statements or as both at the same time. Variables may be interrogated and altered, memory may be examined and breakpoint facilities are ►

► provided. These allow you, for example, to watch a variable and break only when it reaches a certain value or when it has been altered a given number of times. The program may be keyboard-driven or mouse-operated and it has online help in case you forget how a certain command works in the middle of a debugging session.

How does the compiler itself fare? It achieves much the same speed as Aztec C in most standard tests. Aztec wins some benchmarks and Microsoft noses ahead in others. The famous 'sieve' benchmark, for example, is faster when compiled with Microsoft C but a file-copying program is faster when written in Aztec C. Overall, Microsoft probably has the edge.

Microsoft C is supplied with a very extensive library including a host of Unix system V and ANSI functions. The whole package has been written with the forthcoming ANSI standard for C very much in mind. It is the only compiler reviewed here, for example, to support the new `#pragma` directive.

The package also scores heavily on documentation: three standard IBM-size manuals are provided. The first is a complete user's guide to the compiler, linker and so forth and to the DOS interface and special features. The second manual covers the runtime library, with one function per page. The final manual in the suite is devoted to CodeView and a thorough and precise definition of the C language as accepted by the compiler. Although this section is not intended as a tutorial, a seasoned high-level language programmer could learn C from it. As it covers the newer facilities of the language it is often more useful than the Kernighan and Ritchie definition, which predates these facilities.

Although the Microsoft assembler is unfortunately not provided with the compiler – it is an essential part of any serious PC programmer's library – the compiler assembler interface is explained in great detail and the startup source code is provided for those who wish to alter it for specific requirements. For example, I have written very useful interrupt-driven routines in C with only a relatively minor assembler interface.

The Microsoft C compiler supports two register variables, just like Aztec C, and like that system benefits from the extra speed these offer when used properly and sensibly.

A really useful feature, introduced with Microsoft C and now being adopted by other compiler manufacturers, is the provision of special keywords to overcome the limitation of a memory model. Memory models are something forced upon the programmer by Intel's processor design – segmentation in 64K lumps. Standard models are *small*, meaning up to 64K each of code and data, *medium*, meaning 64K of data but almost unlimited code size, *compact*, where there is up to 64K of code and

PtC II

unlimited data, and *large*, where there is unlimited code and unlimited data. Naturally, each model has its price. Whenever code or data has to breach the 64K segmentation limit, 20-bit addresses need to be used rather than the standard 16-bit ones. These are slower and larger. Note that memory models are not a facility forced on us by any C compiler – all C compilers must support one or more of these models. Aztec C, for example, supports the four standard ones mentioned above. Microsoft C extends these models by allowing mixed-model programming. It also introduces a new concept called the huge model. Although compact and large models allow unlimited data sizes, they still are limited to addressing data elements up to 64K in size. An array of 120K, for example, is very hard to cater for. The huge model overcomes this limitation. As part and parcel of this, Microsoft C introduces new keywords to allow you to specify that a function or data item has a *near* (i.e. within the same segment), *far* (in another segment) or *huge* (like far but overcoming the maximum data size limitation) attribute. This gives programmers the opportunity to use, say, small model, yet still access more than 64K of data. It is a feature which I find myself using regularly.

Other new keywords include pascal, fortran and cdecl. Pascal and fortran have

Test	Secs Microsoft C V4.00	Bytes
1	0.05	3757
2	1.3	3757
3	1.3	3757
4	1.3	3757
5	2.0	3773
6	1.8	3773
7	9.9	16293
8	10.5	16293
9	3.5	3789
10	2.9	3773
11	1.8	3805
12	2.7	3773
13	2.1	3821
14	2.1	3821
15	52.1	17893
Avg	6.22	

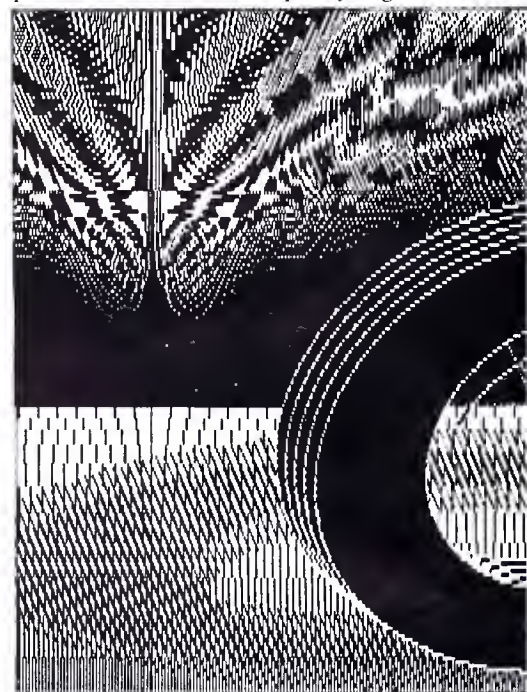
similar effects. When used on a data item the keyword causes that item to have its public (i.e. globally accessible) name in such a form that it can be accessed from modules written in Microsoft Pascal or Fortran. When applied to a function, the function is coded to accept parameters in the Pascal manner rather than C manner. That is, each parameter is passed to the function in the order declared, rather than in reverse order, and it is the called function's responsibility to remove the parameters from the stack before returning. This is marginally faster and smaller than C's mechanism, but is slightly less flexible in that a Pascal function cannot

have a variable number of parameters while a C function may. The option to choose the mechanism is welcome and useful.

When seen as an overall development package Microsoft C is let down only by the omission of the assembler which needs to be bought separately. In all other respects it is eminently usable and highly recommended.

Zorland C

Zorland C is the exception which proves the rule. It is by far the cheapest compiler reviewed here. Although it is not as powerful or as well documented as Microsoft C or Aztec C, its price makes a buying decision very tough. It is probably fair to say that most new C programmers and semi-professional programmers could easily justify the purchase of Zorland C while finding the price of the others unacceptably high.



What does this bargain compiler offer? Essentially it is Lattice-compatible (even down to the assembler interface), with a usefully large library and amazing compiler speeds. Although it is approximately five times as fast at compiling as Lattice C it generates equal or faster code. Initial tests led many users to believe that the compiler was in fact a direct clone of the Lattice product but further experimentation showed it to be faster in a number of cases.

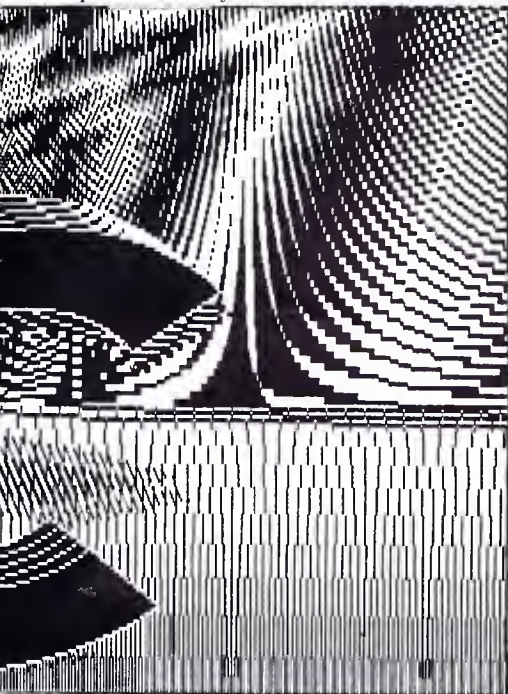
Zorland C, like Lattice C, offers no register variables but does come with 8087 support and the provision of the four major memory models if the developer pack is bought too. Zorland C does not come with a linker as this is supposed to be a standard part of DOS. Some computer manufacturers, such as Amstrad, choose not to include the linker though, so Zorland C users are faced with a problem. This is nicely solved by Zorland's own linker and librarian package, priced at £10 less than the compiler. Although Zorland claims this

linker to be fully compatible with the DOS linker it misses out on a few of the more esoteric features. To most programmers and users of Zorland C this is not important, but for those requiring the full linker they must get hold of the Microsoft product.

Zorland C's documentation is a thin A4 booklet which describes the operation of the compiler and its assembler interface. It really is remarkably similar to Lattice C and shows that there is no need to pay a vast sum.

Lattice C certainly has a larger library, but that provided with Zorland C is easily adequate for most purposes as far as this review is concerned, anyway.

The compiler attempts to be close to the proposed ANSI C standard and indeed supports enumerated types, the void data types and a few other extras. It also supports the keywords const and volatile,



which are reserved but unused by most other systems.

Benchmarks show that Zorland C is remarkably fast when compared against

Test	Secs Zorland C V1.10	Bytes
1	0.7	3173
2	2.7	3189
3	2.7	3189
4	2.6	3189
5	3.4	3189
6	3.4	3189
7	4.0	4721
8	4.2	4737
9	5.0	3227
10	4.7	3205
11	1.3	3207
12	4.4	3205
13	2.1	3239
14	2.2	3239
15	17.8	20183
Avg	4.08	

other low-cost compilers. More importantly, it shows a certain rather more venerable compiler that its days are numbered.

Pt II

Lattice C

This compiler system has been around for a long time and its adoption by Microsoft and others in the early days gave it an enviable reputation. Those were the days of version 2.15. Since being dropped by Microsoft, Lattice has tried to answer its critics by releasing version 3.10 of the compiler. This produces faster and smaller code but still fails to match younger contenders. There is still no support for register variables, but ANSI/System V extensions are added including enumerated types and a set of functions.

Test	Secs Lattice C V3.10	Bytes
1	0.05	4488
2	2.7	4504
3	3.0	4504
4	2.5	4504
5	3.4	4504
6	3.5	4504
7	4.3	4776
8	4.3	4760
9	5.4	4520
10	4.6	4520
11	1.7	4536
12	4.3	4520
13	2.2	4552
14	2.1	4552
15	4.3	9174
Avg	3.22	

The new library is probably the largest of those provided with the compiler systems reviewed, but this is partly explained by the duplication of a number of functions by the simple technique of having them present under their ANSI/Unix names as well as under their Lattice names "for compatibility". A number of functions are provided to allow low-level DOS disk file access in a way which is perfectly adequately supplied with the standard open and fopen families. Lattice gives the impression of scrambling to find functions to fill its library.

The documentation is supplied as a pair of thin ring-bound paper-covered books, one to describe the compiler and other command programs and one to document the library. The print quality is better than Zorland's but worse than Microsoft's. The books themselves, though, tend to fall apart under heavy use.

The release of Zorland C shows that a cheap compiler can offer much the same facilities while Microsoft C, priced at much the same level as Lattice C, offers much more. Lattice is renowned for its technical support, provided by Roundhill and Bix in the UK, and a vast number of third-party products exist for the Lattice family, so some users will find reasons to spend their money with Lattice. I doubt though, that manufacturers of C-related products will bother to describe them as "compatible with Lattice C" for much longer.

Conclusions

The MS-DOS C compiler battle is a two-horse race. If you want a very reasonable compiler at an almost unreasonably low price, then Zorland C fits the bill very nicely. Its compatibility with Lattice C helps a lot if you have much Lattice code or some old Lattice-only third party libraries. These days, though, most manufacturers of C compiler add-ons tend to make the code compatible with most C compilers, not just Lattice's. Zorland C's library is not as extensive as its competition's, but the basics are there. The documentation is obviously not in the same class as Microsoft's but the average programmer should have no problems. The lack of register variables is a pity but nothing to cry about when you are spending such a small amount of money.

Microsoft C V4.00 is the winner at the top of the market. In fact, it wins by a large margin due to its excellent code, its vast library, its exemplary documentation and of course the magnificent CodeView debugger. What finally converted me to Microsoft C was the provision of the huge and far data type modifiers, which easily overcome the Intel problem of 64K segments. Microsoft C is not cheap but if you are a professional programmer you should not stint on your tools.

Aztec C in its Commercial guise is equally good in terms of the code produced. In fact, a program compiled with Aztec C is generally quite a lot smaller than when compiled with Microsoft C. Another plus is the provision of library source, DOS 1.0 and CP/M-86 support and of course the ability to generate ROMmable code. If you are developing non-PC 8086 boards then this is the more obvious choice. It is more expensive than Microsoft C and only the Commercial package really has the advantages. The library is pretty large and compile/link times are better than most, but its documentation is rather confusing.

Lattice C comes a poor fourth. In my opinion this compiler has had its own way for quite long enough. After many years of development, it still does not support register variables and still produces bulky, slow code. It can boast an extensive library, but its documentation is not that much better than Zorland's and it costs a small fortune in comparison. I would find it difficult to justify the purchase of this compiler over even Zorland C, let alone Microsoft.

Suppliers:

Zorland C

Zorland Ltd (01) 854 1194

Microsoft C

Microsoft (UK) Ltd (0734) 500741

Lattice C

Roundhill Ltd (0672) 54675

Manx Aztec C

Grey Matter Ltd (0364) 53499

SOFT RELEASE



GRAND PRIX
CONSTRUCTION SET

Brands Hatch	Stone	Monaco	Silverstone	Thruxton	Knockhill	Thruxton
Thruxton	Thruxton	Thruxton	Thruxton	Thruxton	Thruxton	Thruxton
Thruxton	Thruxton	Thruxton	Thruxton	Thruxton	Thruxton	Thruxton

SUPERIOR SOFTWARE
ACORN SOFTWARE
Compatible with the BBC B, B+ and Master Series computers

BBC Micro Cassette £9.95

Grand Prix Construction Set
BBC B, Master
£9.95 cassette, £11.95 disk
Master Compact £14.95 disk
Publisher: Superior Software

Screaming round corners at 240mph is one of life's least boring experiences. And when you make a right-hander with the tyres just starting to smoke against the left kerb and the car on the verge of going airborne and find that someone has put another bend right in front of you things really start to get entertaining.

Superior's new shot at the software charts, *Grand Prix Construction Set*, is based on a simple premise. It doesn't matter how convoluted a race track is, eventually you'll get to know it so well that it becomes too easy. The answer is to let you design your own tracks or, even better, get friends to design tracks for you so those bends come as even more of a surprise.

This game is based on Scalextric which in my day was regarded as an essential part of any self-respecting adoles-

cent's survival kit. When you first boot up the program you get the option to design a track, load in one you've previously designed or choose from the 18 predefined circuits. These include all the old favourites like Brands, Monaco, the Stone and so on.

Designing a track is simply a matter of positioning the start/finish straight and then selecting the other parts, like corners, chicanes or straights. Once designed the circuit can be named and saved, although it is not possible to edit tracks, which is a shame.

Then the real surprise comes. This is a two-player game. The game screen has two main windows each showing a 3D view of a car on the track. You can play against the computer, with five skill levels or any convenient humanoid. You choose the number of laps (1-9) and then it's time to burn rubber.

When you're losing you see your opponent's car in front of you — assuming that it isn't a complete whitewash. At the bottom of the screen are two

diagrams of the circuit, one for each car, showing your positions on the track.

Any racing game for the Beeb has to stand up against the sublime *Revs*. Surprisingly, this one doesn't do too bad. Alright, so it hasn't got the realism. There's no gear changing. Indeed, controlling the car is pretty easy, and the vehicles are exceptionally forgiving around bends. There is one wonderful ingredient though — competition.

As you are up against just one other car, which might be controlled by someone sitting next to you, there is real excitement as you battle your way round the circuit.

As far as simulations go, *Revs* is still untouchable. Its realism gives it the edge when you feel you need to test yourself against some stiff competition. But *Grand Prix Construction Set* is novel, fun and thanks to the track designer, should keep you amused as long as you can keep thinking up new designs.

Slick Garrett

Agent Orange
Commodore 64
Publisher: A'n'F Software

We'd better not get into a debate on the morality of calling a game after Agent Orange, the so-called defoliant that did such horrific damage to people in Vietnam. No doubt everyone will have their own view on the good or bad taste of that idea — though whether it's any worse than the usual bombs and bullets of the average computer game, I don't know.

Whatever your thoughts, this game is set in a far future when Agent Orange is valued for its true defoliant properties. Needless to say, another civilisation has it, yours doesn't, and it's your job to get out there after it. Out there is a sequence of eight planets, the last of these containing the Agent Orange, and you won't be surprised to learn that you have to travel through the other seven planets first, each infested by alien craft.

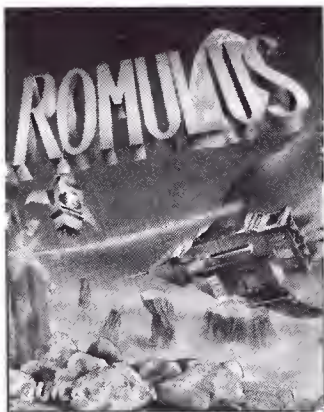
There's more to the game than the simple sequential blast, though. Mind you, that's not bad in its own right, although the speed of your ship is achingly slow compared to most games of this type. The battles with aliens are real dog-fights, as you weave and turn and try to get them in your sights, and on the final screen, which I've reached several times but never got through, the opponents are real little devils.

What the aliens are doing on these planets is attempting to harvest them — though one man's harvest is another man's weed, and so you're trying to keep the planets clear in order to harvest your own crop. This you do simply by flying over virgin soil with your fire button pressed, causing seed pods to be scattered on the ground. These grow under the same rules as the *Life* computer game, and later you can return



to harvest the crop by flying over it. When you dispose of an alien, you can pick up its own jettisoned cargo to add to your own booty, but you have to wait a while for the debris to clear and also watch out for other aliens in the vicinity, as these are programmed to head straight for the cargo and reclaim it. Many a mid-air collision results.

On the harvesting side, you've obviously got to decide where best to plant your seeds, and when to harvest them — leave them growing and hope they'll flourish or take them now in case the weeds overwhelm them and kill them. A



planet's surface fills up pretty quickly, too, so do you hang around or head for the virgin soil of the next one?

You can only travel to the next planet when you've rid the current one of aliens, but at any time you can return to your mother planet for a bit of trading and cashing in of the crops. If you build up your credit rating you may be able to afford more and better ships – and you're really going to need them as the game progresses!

The graphics are good (lovely loading screen), the sound does its job, and my only quibble is that the final screen is suddenly infinitely harder than all the screens that have gone before, where the aliens' movement patterns can often be predicted. Apart from that, and a wish that they'd called the game something else, this one should be as much a winner for A'n'F as *Chuckie Egg* was in its time – and what a long time ago that daft innocent game seems.

Mike Gerrard

Romulus
Commodore 64
Publisher: Quicksilver

Sometimes it works, more often it doesn't, when a programmer tries to borrow ideas from other games but inject something different in the hope of coming up with a winner. Everything including the kitchen sink seems to have been thrown into *Romulus*, but unfortunately it hasn't produced a game that's really addictive and playable.

The story is irrelevant, but just for the record you're meant to be clearing the bugs out of a transputer, which is an enormous computer. What this boils down to on-screen is a scrolling play area in the centre along which you pilot your craft blasting away at the many and assorted shapes that are blas-ing away at you. Move the joystick to the left and you move left, speeding up as you go – or rather the background scrolls ever-faster to the right. Move

the stick to the right and eventually you slow down and swivel to face the other way, aiming to clear the decks in that direction. Original? No, not very.

When you're competing against the standard of graphics set by something like *Uridium*, you've got to come up with something special, and *Romulus* doesn't. If we hadn't seen several similar games then we might be impressed, but this craft that you're flying doesn't stand out from the background like it should – there is little sense of depth about the screen, and the fuzzy look of the craft doesn't help. Bold colours with clean crisp edges are what the game lacks.

There are two mini-games between sections of the main gameplay, in one of which you compete against the computer trying to be the first to hit six targets – the computer moves at the speed of light, so instant failure doesn't endear this game to you. The other has you trying to match three pairs of shifting colour patterns by slowing the speed and changing the direction of movement of one of them, but it lacks the Minter touch that an interlude like this needs. The hairy one would have knocked these out before breakfast as limbering-up exercises.

Future Knight
CBM64/Plus 4/C16/Amstrad
CPC/MSX/Spectrum
Publisher: Gremlin Graphics

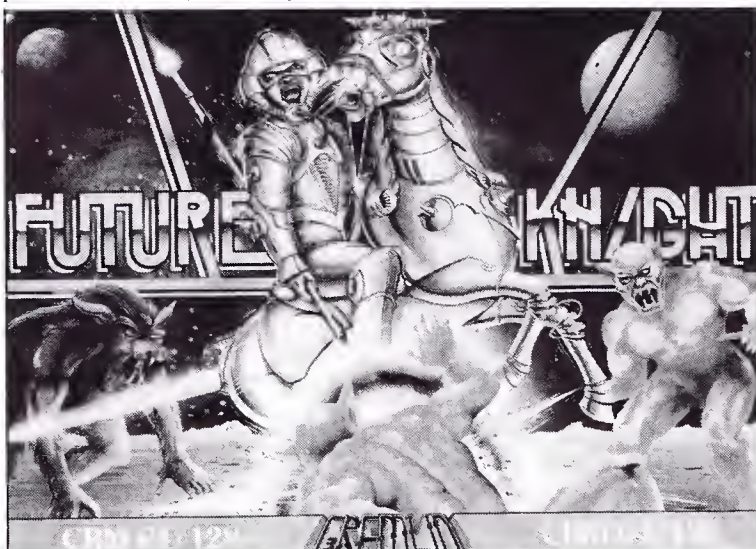
I always worry when I open up a game and the bulkiest thing about it is the instruction sheet, but this one's not as bad as it first seems as it covers several machines and every language from ancient Greek to Serbo-

Croat. Roughly translating all of them, they boil down to this: if it moves, shoot it, and if it doesn't, pick it up. If you can't shoot it, get out of the way.

Though played on the CBM64, the graphics have a chunky BBC look to them, which is about the only machine it isn't available for. As for the storyline, any game that has a villain called Spegbott the Terrible can't be all bad. Spegbott, it seems, has stolen your loved one, the fair Amelia, and acting upon a signal received from the SS Rustbucket you troll off without further ado to Spegbott's planet where you must make your way up through 20 levels to the planet's surface (how did you

You need a joystick to move the hero, Sir Randolph, around the screen, with each level being fairly small in total area and made up of interconnecting ladders and platforms, and a few million beasties for good measure. These float around and crawl about, and most can be blasted with your gun, while almost all can be killed if you are prepared for a head-on collision. This doesn't do much for your strength that's counting down from 999 at the foot of the screen, however.

Other objects can be picked up on your travels, such as bombs, bridges, sceptres and exits, and pressing the space bar puts any of your objects to use – you don't have to specify



get down beneath the surface in the first place?), then to Spegbott's castle and the rescue of Amelia. Hopefully she'll display her gratitude, as being in the clutches of Spegbott the Terrible can hardly be the pinnacle of a young girl's dreams.

To earn her gratitude, though, you have to trek your way through a kind of shooting platforms and ladders game that's entertaining enough without ever really becoming exciting. The sound effects are disappointing, and though there's a lot of detailed graphics and amusing-looking creatures around, the whole game plays rather slowly and doesn't really provide any incentive to get up to the more advanced levels.

which one, the program knows which is usable in which situation.

If you find the likes of *Uridium* and *Sanxion* too fast for you, and prefer a more sedate pace, then this might appeal, but as for me I was content after a while to wish Amelia and Spegbott a happy future together.

Mike Gerrard

Star Raiders II
Commodore 64
Publisher: Electric Dreams

As computer technology advances, as 16-bit machines become the norm, as programmers squeeze every last bit (so to speak) from each new

SOFT RELEASE



► machine, as we advance through blitter chips and as-yet undreamed-of wonders, what are all we computer buffs really looking for in the ultimate machine? That's right, the chance to zap those aliens even faster. Never mind the benchmarks, how does the latest game affect your blood pressure?

Not having seen the original *Star Raiders* (sackcloth and ashes, I know), I can't say how this follow-on compares, but I can say it had me on the edge of my seat as I tried to defend the Atarian Federation, which I thought was safe enough in the hands of Jack Tramiel, but it seems he needs a little help now and then.

The danger to the Federation comes from the fact that the evil Zylon Master, a certain Chut, is keen to destroy the place for reasons best known to himself. You must step into the pilot seat of the meanest fighter ship in the galaxy, the Liberty Star, and blast the Zylons out of the heavens.

Well thought out instructions introduce you to the several screens you'll be moving between, the main one being the zap-'em screen where the Zylon Fighters and Destroyers appear in their various fleets. Pressing the space bar takes you to a map of the galaxy, where an icon in the form of a handy hand can be moved about and transport you instantly to any place via space warp technology. You'll need to warp to Space Stations when your fuel supplies get low, so don't neglect that when the warnings print out at the top of the screen.

On the zap-'em screens it's a matter of getting the ships in your sights and eliminating them. Fighters aren't too bad, but those Destroyers are mean mother-ships and it's the devil's own job to get them into your sights. Even then you may need a few blasts to see them off. Blast all the ships out of one section of the star system you're defending, then press the space bar to check out the situation elsewhere by moving the hand icon around. It is best to protect the planets closest to the Zylon's own star system first, Procyon, and there are numerous other tactics you'll discover from the notes or as you play – usually at considerable cost to the Liberty Star.

As one who appreciates the intellectual challenge of an adventure game, I have to say that this raucous shoot-out has no redeeming features whatsoever in that respect, it's just a colourful, speedy blast. If you're the type who thinks *Elite* would be great if it wasn't for the boring trading bits, this is definitely for you.

Mike Gerrard

Wibstars

Spectrum 48K

Publisher: A'n'F Software

"Hey, now here's a wacky, zany idea for a game, John... running a software distribution company!"

"It's new, Brian, it's different. I like it... but strategy games don't make money, do they?"

"No problem, John, we'll make it an arcade game... we'll make it several arcade games in one! Remember *A View to a Kill*?"

"Who could forget it?"

"Yeah, well what I mean is, like that only good. We'll pinch the idea... er, I mean we'll borrow the concept but produce a totally original and utterly brilliant game of our own."

"What about a title, Brian? It's got to have a good title."

"Yeah, catchy, but sort-of really explaining what the game's all about... How about

Rip-off the Punters?"

"What???"

"Just a joke, John, just a joke. Think of some software distribution companies, I mean people the kids in the street will have heard of."

"Let's see, there's... there's... well there's Websters."

"Brilliant! We'll call it *Wibstars*. Geddit?"

"Well, maybe... it'll do for now, anyway. The thing is, how do you see the game?"

"Start in the warehouse, John. Obviously you've got to load your lorry up with product before you get it out on the street. I know, down the left-hand side of the screen we'll have a tape, a disk and a computer, and you control a little man in one of those dumper trucks, what do you call them..."

"Fork-lift?"

"Pardon? Oh, right, I'm with you. Anyway, joystick or keyboard, right, the reviewers like that kind of thing. You can redefine the keyboard as well, they love that. So you move your truck up against each of these graphics."

"Hang on, Brian, what's that new word people keep using, not graphics these days..."

"Icon, John? Well, not really icons, just drawings of cassettes and disks, and you give the player £200 and he chooses what to buy with it."

"I thought you said no strategy."

"Oh, just a bit... appeal to the intellectuals."



"Not too much, though."

"No, right, anyway, when the truck's loaded up we switch to another game."

"You mean that's it for the first part?"

"Oh yeah, but it'll get harder, John, it'll get harder. The next section I see... I see a lorry moving along the street."

"Scrolling?"

"Yes, it's these new under-pants... oh, scrolling screens, yes, love it, drive the lorry up the screen... hazards, though, got to have hazards. Got it! There's another lorry in front and it's spilling things out of the back... and it's (you'll love this) it's *another* software distribution lorry! You can pick up even more disks and tapes and stuff if you run over them in your lorry, but you've got to avoid the nails that are also coming out with them."

"Will it be harder, though?"

"Of course, John. I know, we'll make the things you want and the things you've got to avoid come out of the lorry at the same time! Might lead to attribute problems, but it could make it really difficult, John."

"Room for another game, though, Brian?"

"Oh yes, John, got to have three sections, they all have three sections. The third one I see... I see... I see platforms and ladders, John. I see moving conveyor belts... I see lifts..."

"I see writs from the Manic Miner people."

"Oh no, we'll just have the one screen and it'll be so duff they'd be ashamed to say it resembled any of theirs."

"Just the one screen, Brian?"

"Be running out of memory by this time, John. But I think we should go ahead with this one. And I've got just the programmer, he turned up on the doorstep last week. He's brilliant, only twelve years old and

he knows Basic and everything."

"Let's get moving then. I can see the reviews already..."

"Yeah, absolute crap, they'll say."

"What???"

"Just joking, John, just joking."

Mike Gerrard ►

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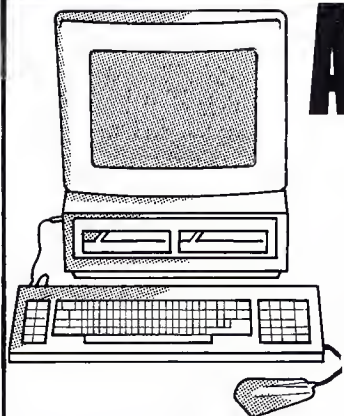
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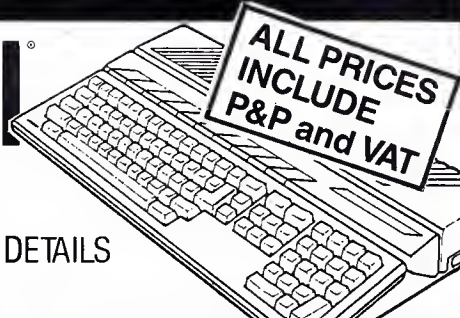
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SOFT RELEASE

Spell-Master
BBC B, B+, Master 128, Master Compact
£59.00 (ROM)
Publisher: Computer Concepts

Beeb users swear by their word processors but usually swear at their spelling checkers. Until now, the only half-way decent program was *ViewSpell*, which works only with View and takes forever to check your text.

Now Computer Concepts has produced a totally chip-based spelling checker which is genuinely useful, and which can be used with View, Wordwise and InterWord.

The software comes on a 128K ROM – well, actually it comes on two ROMs mounted on a carrier board, which can make fitting difficult, especially on a Master. Computer Concepts is promising to put it on a single chip soon.

The makers claim that there are 50,000 words in the dictionary and because it's all on chip that it checks at 10,000 words a minute. I found no reason to doubt those figures.

The program can be used in three ways. You can check the whole text while you are in the word processor. The program shows any word it doesn't like together with the lines above and below, so you see it in context. You can ignore the word, add it to the user dictionary or correct it. If you decide to correct, the program finds the nearest match it can with something in its dictionary, but you are free to browse. Once you have found the word you want, simply hitting Return swaps it with the faulty one.

Alternatively you can check as you go. When you finish typing a word and hit the space bar the software gives out a beep if it's a word it doesn't know. You can ignore the beep or you can ask it to help by providing alternative spellings.

The third method is to use *Spell-Master's* built-in text editor to load in a file and check in a similar way to the first method. This is all a bit awkward –

you might as well use your normal word processor. But the editor does have other uses.

Creating a user dictionary is very simple but has one unusual requirement. You must have sideways RAM fitted in your machine. This is no problem for Master 128 and Compact owners, as it comes with the machine, but model B owners will have to supply their own.

The software uses the SRAM as a data store. To create the dictionary you type the words into the editor which has menu options for setting up the dictionary. The software comes with a star command for saving and loading the dictionary. Adding words can be done from the correction menu or by downloading the data into the editor and typing the words in.

The advantage with this approach is speed. Checking is practically instantaneous as there is no disk access. The main disadvantage is that you have to remember to save the dictionary each time you update it.

There are a few other features worth mentioning. The crossword command allows you to type in a word, replacing any letters you don't know with hashes. It will then give all the matches it can find from its dictionary. There is another similar command for anagrams.

Worthing J. Phillips

— — — — —
Mini Office II
Commodore 64/128
£16.95 cassette, £19.95 disk
Publisher: Database Software

Mini Office II is an integrated suite of business programs which, the cover says reassuringly, turns your computer into a versatile business machine. Load this disk and your very own Commodore 64/128 will instantly help you write letters, prepare reports, compile mailing lists and carry out complicated calculations (yes, even complicated ones). The reason-

DATABASE SOFTWARE



ably user-friendly, manual explains everything the program can do in well-signposted sections, designed to assist those of us who break into a cold sweat when faced with anything that resembles a menu full of incomprehensible commands.

The word processor promises to "transform a dull, error-ridden piece of prose into an attractive, concise expressive document". I was disappointed to find that it could not eradicate clichés and perfect my style while I went out for lunch. Although useful, the editing features are restricted to the usual block moves and deletions, automatic search-and-replace and the like. Miraculous it isn't. All the necessary commands are listed and explained in a useful summary at the back of the manual, as are the spreadsheet commands.

Also included are a database, graphics (essentially bar, pie and line charts). The graphic display options are represented by icons to help you make an informed choice about the final presentation. Information can be entered directly or retrieved from the spreadsheet. In the same way database infor-

mation can be included in text, for example if you have to write grovelling letters to more than one bank manager. This is all pretty standard of course but it's pleasant to have it explained so simply and means that frightened beginners will be able to make full use of Mini Office II's multitude of skills.

You might feel that a manual which describes a database as a filing cabinet was being slightly patronising. This slight grumble is more than adequately fielded by the clarity of the instructions which lead you through creating and structuring files.

Finally a communications section will link you to Micro-Link and Telecom Gold, if you have a modem. Other systems can be reached if your competence extends to entering their characteristics. "The exciting world of online living" is opened up by a few simple no-fuss keystrokes.

This simple and well presented package is going to help a lot of people perform all the tasks they need without the grief inherent in more complex and sophisticated programs not intended for the beginner.

Carol Attack

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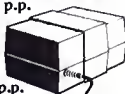
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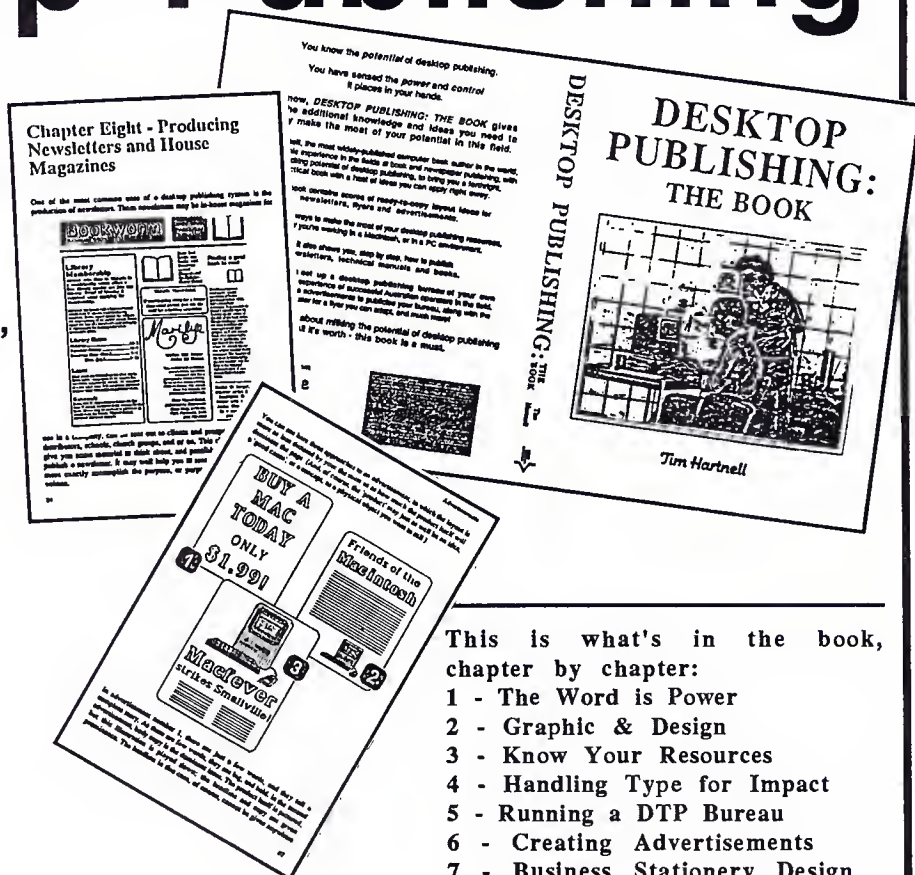
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- * 512Kbytes RAM (520ST-M, FM)
- * 1024Kbytes RAM (1040ST-F)
- * 192Kbytes ROM
- * 128Kbytes external plug-in ROM option

ARCHITECTURE

- * Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
- * 16-bit external data bus
- * 32-bit internal data bus
- * 8-32-bit data & address registers
- * 7 levels of interrupts
- * 56 instructions
- * 14 addressing modes
- * 5 data types
- * DMA (Direct Memory Access)
- * real time clock as standard

GRAPHICS

- * full bit-mapped display
- * palette of 512 colours
- Using Atari Monitors (on 520 & 1040):
- * 640x400 high resolution - monochrome
- * 640x200 medium resolution - 4 colours
- * 320x200 low resolution - 16 colours
- * 80 column text display (40 col low res)
- Using Domestic TV (on 520):
- * 640x200 medium resolution - 4 colours
- * 320x200 low resolution - 16 colours
- * 40 columns x 25 line text display

SOUND AND MUSIC

- * 3 programmable sound channels
- * frequency programmable 30Hz - 125KHz
- * programmable volume
- * wave & dynamic envelope shaping
- * programmable attack, decay, sustain, release
- * Musical Instrument Digital Interface (MIDI)
- * MIDI allows connection of synthesizers etc.

STANDARD SOFTWARE

- * GEM desktop - TOS operating system
- * ST BASIC interpreter/language system

MOUSE

- * high precision
- * 2 button control
- * free with 520ST-FM/1040ST-F
- * non slip ball motion sensor
- * removable ball for easy cleaning

INPUT/OUTPUT

- * MIDI out (5 pin DIN) 31.25K baud
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- * mono monitor 1.0V DC, 75 ohm
- * mono horizontal scan rate 35.7KHz
- * mono vertical scan rate 71.2KHz
- * sync 5V OC (active low) 3.3K ohm
- * modem/serial RS232C, 50 to 19,200 baud
- * floppy disk 250 Kbits/s
- * hard disk 11.3 Mbits/s
- * mouse standard Atari connector
- * joystick standard Atari connector
- * cartridge port 128K capacity
- * RF output (520ST-FM) for TV use

OPERATING SYSTEM

- * TOS with GEM environment in ROM
- * hierarchical file structure with sub-directories and path names
- * user interface via GEM with self explanatory command functions
- * multiple windows + icons
- * window resizing, re-positioning and erasing
- * drop down menus (selected by mouse)
- * GEM virtual device interface

COMMUNICATIONS

- * RS-232C serial modem port
- * 8-bit parallel printer port
- * MIDI port (also for networking use)
- * VT52 terminal emulation

KEYBOARD

- * standard QWERTY typewriter format
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520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a 1/4 Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a 1/4 magabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages:

- 520ST-FM Keyboard Without Monitor - £399 (inc VAT)
- 520ST-FM Keyboard + High res mono monitor - £499 (inc VAT)
- 520ST-FM Keyboard + Low res colour monitor - £599 (inc VAT)
- 520ST-FM Keyboard + Med res colour monitor - £699 (inc VAT)

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external delectors to clutter up your desk space. You are left with only one main lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1024K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a miniframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one main lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

- 1040ST-F Keyboard Without Monitor - £599 (inc VAT)
- 1040ST-F Keyboard + High res mono monitor - £699 (inc VAT)
- 1040ST-F Keyboard + Low res col monitor - £799 (inc VAT)
- 1040ST-F Keyboard + Med res col monitor - £899 (inc VAT)

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one main lead.

£599

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To: Silica Shop Ltd, Dept YC 0587, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

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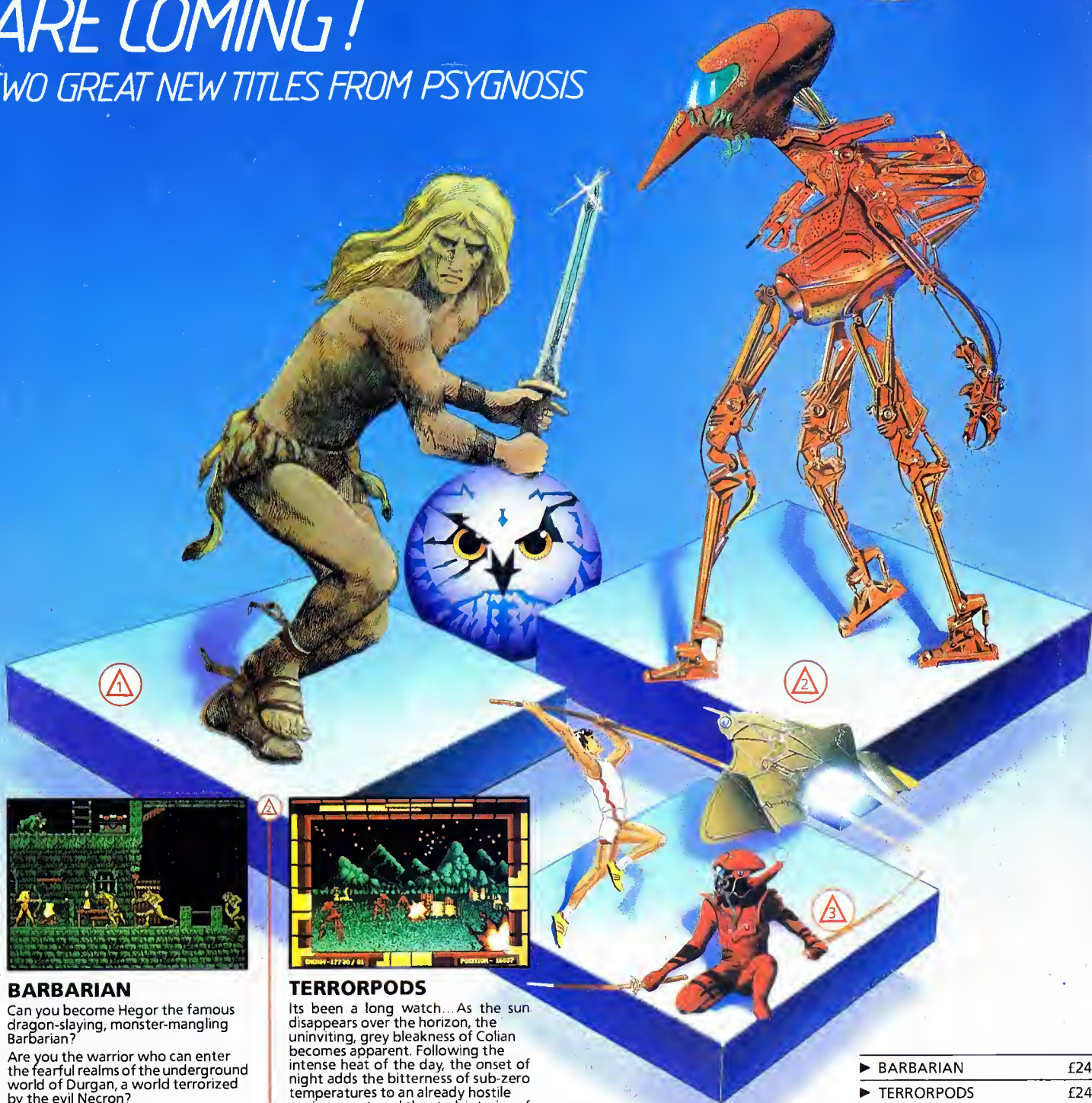
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It's been a long watch... As the sun disappears over the horizon, the uninviting, grey bleakness of Colian becomes apparent. Following the intense heat of the day, the onset of night adds the bitterness of sub-zero temperatures to an already hostile environment, and the stark interior of the D.S.V. appears almost homelike.

Deep melancholy is suddenly smashed by the shrill scream of a siren. The status panel has gone crazy, an extraordinary array of lights flash uncontrollably. Good grief... what's happening?

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► DEEP SPACE	£34.95
► BRATACCAS	£34.95
► ARENA	£29.95
► ARENA BRATACCAS	£34.95

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